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BRITISH MINERALOGY:

OR

COLOURED FIGURES

INTENDED TO ELUCIDATE

THE MINERALOGY

OF

Great Britain.

BY JAMES SOWERBY, F. L. S.

HONORARY MEMBER OF THE PHYSICAL SOCIETY OF GÖTTINGEN,

DESIGNER OF ENGLISH BOTANY, AUTHOR OF ENGLISH FUNGI, ETC.

(With Assistance.)

As for the Earth, out of it cometh Bread, and under it is turned up as it were Fire. The Stones of it are the Places of Sapphires; and it hath Dust of Gold. Job xxviii. 5, 6.

VOL. I.

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MDCCCIV.

TO

THE RIGHT HONOURABLE

SIR JOSEPH BANKS, BART., K. B.,

P. R. S., H. M. L. S., P. R. I., ETC.,

as the grand Promoter of every Science connected with Natural History, especially Agriculture, to which the Study of Mineralogy forms so necessary an Appendage, I, with gratitude for his kindness, a second time dedicate my labours. That they may be useful, is the sincere wish of

His most obedient humble Servant,

JAMES SOWERBY.

Mead Place, Lambeth,
Dec. 1, 1804.

PREFACE.

THE utility of such a work as this cannot, we presume, be doubted, while the sciences of Botany and Agriculture are so liberally encouraged. We are happy to boast the friendly assistance of men of the first abilities, whose encouragement cannot but be an honour to us. The undertaking was begun at a time when we had but just become aware how far we were behindhand in this most essential knowledge, when even the Diamond, one of the oldest jewels in the known world, had but recently been discovered to be pure Carbon*. Discoveries, scarcely less remarkable, are continually making.

The use of figures to illustrate a subject not generally understood, and which it requires so much study to bring to perfection, will be every day more and more apparent; and we have been flattered by the

* See page 106.

avowal of our scientific friends, that we have in this particular exceeded their expectations.

A prospectus of this work, so new in its nature, and necessarily capable of many improvements as it goes on, seemed to us better omitted. We had rather perform more instead of less than might have been promised.

Of the many systems proposed by the learned, not one has been fully established. We have presumed to form one in a general way, for the present purpose of arranging the plates and letter-press, feeling the greater confidence in the chance of its permanence, as we have endeavoured to make it conformable to nature. We have made combustible genera, among which are included Calor or matter of heat, the different Airs, Alkalies and their compounds, as necessary to be known to every mineralogist, although some are perhaps not strictly minerals. These, with the Earths and Metals, make the three Grand-Divisions or Classes under which we arrange the whole into Orders, Genera, and Species,—the Genera chiefly from their specific gravity. For further particulars, we refer to the Observations on the System.

With regard to the figures, we have thought it quite proper to represent an original specimen, which is apt to give a more perfect idea than geometrical outlines alone; but, to make them more perfectly understood, have annexed magnified and geometrical figures, as thinking them more valuable for being original; as copies of works, however good, are surely not to be preferred; especially as, by seeing what is done before us, we are able to manage the subject better, seeing more properly how to show it in a better position, or correct the mistakes.

Very common subjects will be included, as they are often more essential to the farmer, builder, mechanic, etc., and are generally least known to mineralogists: indeed, we mean to leave no stone unturned, to make the work as universally useful as possible.

We beg our friends to accept our grateful thanks for the assistance we have received in this arduous undertaking, promising them to be ever attentive to their kindnesses, as a work of this universality requires many helping hands.

SKETCH OF A SYSTEM

FOR

BRITISH MINERALOGY.

CLASS I. COMBUSTIBLES.

ORDER I. HOMOGENEOUS.

Genus 1. Calor
2. Hydrogen
3. Nitrogen
4. Oxygen
5. Phosphorus
6. Sulphur
7. Carbon
8. Fluoric Radicle
9. Muriatic Radicle
10. Boracic Radicle

ORDER II. COMPOUND.

Genus 1. Bitumen
2. Ammonia
3. Soda
4. Potash
5. Carbo oxygenizatus

ORDER III. AGGREGATE?

CLASS II. EARTHS.

ORDER I. HOMOGENEOUS.

Genus 1. Argilla
2. Magnesia
3. Calx
4. Silex
5. Strontia
6. Barytes
7. Zirconia
8. Glucina
9. Yttria
10. Agustina

ORDER II. COMPOUND.

Genus 1. Argilla
2. Calx carbonata
3. —— sulphata
4. Quartzum

ORDER III. AGGREGATE.

CLASS III. METALS.

ORDER I. HOMOGENEOUS.

Genus 1. Molybdenum
2. Tellurium
3. Uranium
4. Antimonium
5. Manganesium
6. Zincum
7. Stannum
8. Ferrum
9. Cobaltum
10. Cuprum
11. Arsenicum
12. Niccolum
13. Wismutum
14. Argentum
15. Plumbum
16. Mercurium
17. Tungstenum
18. Aurum
19. Platinum
20. Titanium
21. Columbium
22. Tantalium
23. Chromum
24. Iridium
25. Osmium

ORDER II. COMPOUND.

Genus 1. Ferrum oxgygenizatum

OBSERVATIONS ON THE SYSTEM.

Calor*, or matter of heat, see p. 1. We left out the termination *ic*, because it is not known to be an acid, which is in general signified by that termination. It is placed as the first Genus, from its universality; at the same time we may say it will seldom be joined as the characteristic of a species. The other Genera are placed according to their gravity, and it may not be amiss to say that

Hydrogen is the inflammable part of water, and the next Genus,

Nitrogen, is a part in the composition of atmospheric air, which, without the wholesome genus placed next to it (Ogygen) being combined with it, would be unfit for respiration.

Oxygen is the other component part of water.

Phosphorus is combustible at the temperature of the common atmosphere, and is in nature sometimes combined with Lime and Earths and Metals, as Phosphate of Lime, and Lead—see p. 173—frequently found also in animal slime, and bones.

* We have placed the lightest first, as appearing most natural.

Sulphur is well known in the form of Brimstone, and is found native, or with Earths, Metals, &c.

Fluoric Acid, whose base is not known, is common with Lime—see Fluate of Lime, p. 151. These seven last form gases or acids* with Calor.

The Muriatic Radicle may assist in forming salts —see Muriate of Soda, p. 51.

The Boracic Radicle is sometimes in combination with the Alkali † Soda.

These, in the order Compound, form Species.

Their powerfulness and various combinations being well known, there will be ample field for the Geologists to speculate upon; and *they* may shake hands together, who were adverse advocates on account of the *Volcanian* and *Neptunian* Systems.

Some of the Genera and Species are not properly numbered, as in the beginning of the Work we could not find a sufficiently regulated System, and many of the Species are yet so little known, that their numbers cannot be certain.

* Changing vegetable blue red.

† Changing vegetable blues green.

84 Nos.

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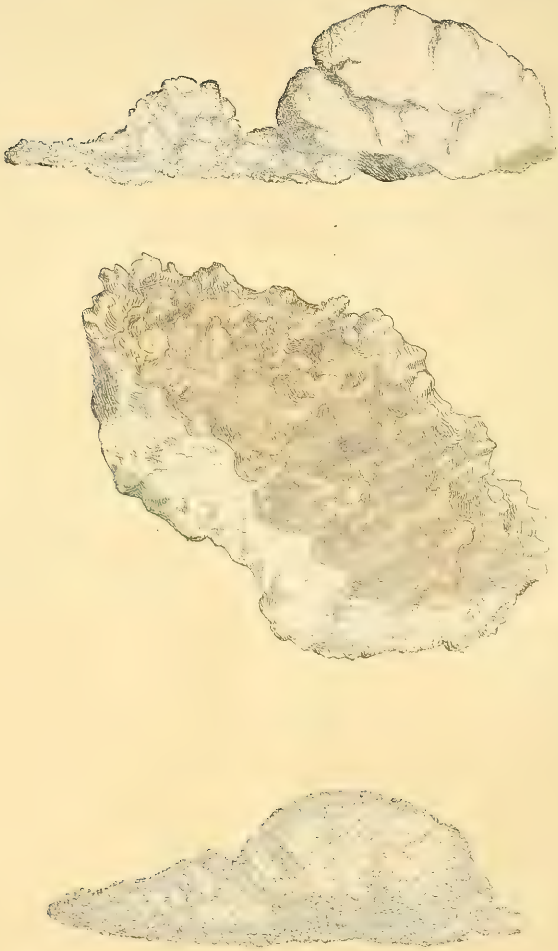

Novr 1 1802 Published by Jas Sowerby London.

TAB. I.

CALX nativa.

Native Lime.

Class 2. Earth*. *Order* 1. Homogeneous. *Bab.*
Gen. 1. Lime. *Spec.* 1. Calx nativa.

GEN. CHAR. Powdery or concrete, with a hot burning taste. Corrodes animal substances. Spec. grav. 2·3, *Kirwan, v.* 1. 5. Precipitates from a solution in water, by adding corrosive sublimate, in the form of a reddish powder. *Kir. v.* 1. 75. Changes syrup of violets green.

SPEC. CHAR. Uncombined.

SYN. Native lime. *Kir. v.* 1. 74, 75.
Pure lime. *Bab.* 7.
Artificial. Calx viva. *Mat. Med.*

QUICK-LIME, or *Calx viva*, is well known, as procured from chalk or lime-stone by means of burning in lime-kilns. In the act of burning it is deprived of an air or gas, chemically termed carbonic acid gas†, loses part of its

* Earths are incombustible, infusible per se, spec. grav. not exceeding 4·9, and white.

† Formerly termed fixed air, discovered by Dr. Black. It is heavier than common air, forming a small or adventitious part of the atmosphere; is readily absorbed by cold water, giving it a brisk taste. As an acid, it turns vegetable blues red.

weight, and takes up caloric, or latent heat of Dr. Black. It is then caustic, with the properties as described in the generic character, changing the syrup of violets green. This character it retains as long as the latent heat or the effect of it lasts, which heat and principle of changing the syrup of violets green will be lost if exposed to a damp atmosphere.

The *upper figure* is done to express artificial lime just exposed to damp air, yet capable of changing the syrup of violets green, and beginning to fall to pieces. If a quantity is suddenly added, it will lose its characteristic property sooner, by absorbing carbonic acid gas from the atmosphere, or the water of which the fire had deprived it in the kiln, and when dried without heat will be nearly what it was at first.

The *middle figure*, *Calx nativa*, from Bath, has qualities resembling quick-lime, and changes syrup of violets to a green, nearly as vivid as that produced by the artificial lime above; and although I have had it two years in the drawer with quick-lime, it still gives a green which the other does not.

The *lower figure* represents lime taken out of a hollow nodule of flint, to which, before it was broken, we could find no apparent aperture. The contents were exposed immediately to some fresh violet petals, pressed so as to afford two or three drops of purple fluid, which it directly changed green. It soon lost that property, and is now a gritty chalk.

External Character of the Bath Lime.

Colour white.

Lustre o.

Transparency o.

Fracture earthy.

Hardness, rubs easily to powder.

It should seem that this passes out of the rocks in a fermentative manner, oozing or frothing. The upper surface of the specimen is somewhat encrusted with a stalactitical substance. The inner part when examined seems partly in bubbles.

Dr. Moreton found lime in the stones of Cliftone pit in Northumberland*, and Dr. Falconer at Bath. Sir John Hill describes a similar substance to mine, which he has seen thrown out of the quarries of Mr. Allen near Bath, and calls it native lime and *Gypsum Tymphacium* of the antients, saying that Theophrastus has left a record of a ship taking fire from the heating of the gypsum among some clothes that were in it, on the accidental admission of wet; and that he does not call it gypsum himself, but an earth only that the people about Tymphæa, &c. called gypsum.

* Since the above was written, Mr. John Hailstone, Woodwardian Professor, of Cambridge, kindly informs me that the *Calx nativa* sent to Dr. Woodward by Dr. Moreton has no pretensions to be a lime.

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TAB. II.

CALX carbonata.
Crystallized Carbonate of Lime.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.

SPEC. CHAR. Lime with carbonic acid effervesces with the stronger acids, and becomes quick-lime in a strong heat.

SYN. Chaux aërée. *Born, v.* 1. 28.
Kalk-stein. *Emmerling, v.* 1. 437.
Aërated or mild calx. *Kir. v.* 1. 75.
Chaux carbonatée. *Haüy, v.* 2. 127.

Div. 1. Crystallized.

SYN. Spath calcaire. *Born, v.* 1. 107.
Kalk spath. *Emmerling, v.* 1. 455.
Foliated and sparry lime-stone. *Kir. v.* 1. 86.
Calcareous spar. *Bab.* 7.
Chaux carbonatée. Formes déterminables. *Haüy, v.* 2. 130.

FOUND chiefly in lime-stone rocks wherever they occur in Great Britain, as Derbyshire, some parts of Wales, Wiltshire, Devonshire, &c.

It is easily scraped with a knife; fracture in laminæ parallel to the nucleus, which is rhomboidal, its obtuse angles being 101° 30′, its acute 78° 30′. When sufficiently transparent, it gives a double refraction. It is never quite opaque, the colours are mostly white or lightish brown, sometimes reddish, seldom yellow or green, scarcely ever crimson, blueish, purple, or black.

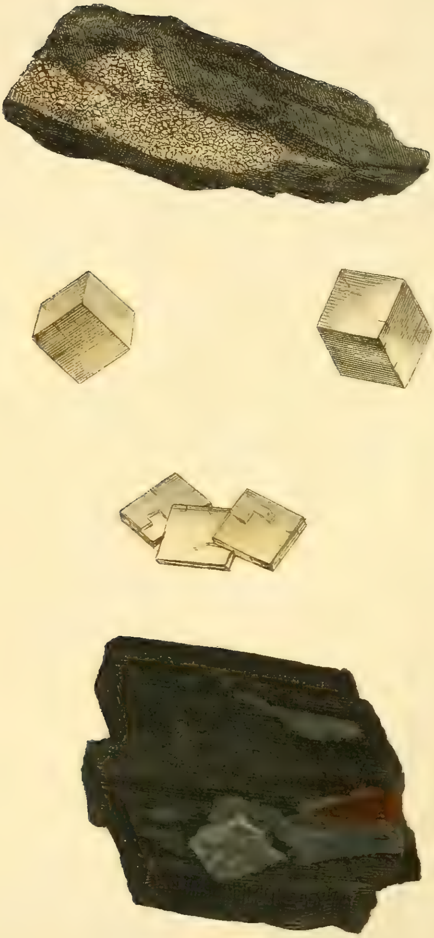
Upper figure a nearly equal-sided fragment, to show the nucleus and the double refracting property, by being placed on a straight line, which appears displaced and doubled when viewed through the upper opposite face. The sides only reflect the object, for we cannot see a figure through the edges of the crystal.

Middle figures the same, somewhat thinner, placed on letters to show that the refraction divides towards the obtuse angles.

Lower figure, a rare fragment of a fine yellow. The prismatic colours caused by the flaws are in the regular order of the rainbow: the brightness depends on the polish of the surfaces, and the closeness of the flaw, nearness to the surface, &c. The upper lighter fracture is paler, because the more open it is the less visible the colours. The opaque white at the edge is in consequence of a blow in a direction contrary to the laminæ, which always bruises it. Please to read 101° 30′, 78° 30′, instead of what is engraved. It was thought proper to picture one face of each of these figures as near as might be to the measured angles* (the largest side of each). It may be fairly observed that, according to the rules of perspective, the other sides could not be seen; some rules may give way to perspicuity occasionally. Small objects cannot conveniently be observed by this rule, and very few people look perspectively, as it requires great nicety. These figures are intended to give a natural appearance to a general observer, who looking with two points of sight sees more of the subject. It is intended to use one point of sight where it should be found most eligible.

We must beg leave to refer our readers to Dr. W. H. Wollaston's learned paper on the oblique refraction of the Iceland crystal (*Phil. Trans. for* 1802, *part* 2, *p.* 381), for an account of its refracting property.

* A fragment placed by the angles will be found nearly to correspond with them.



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TAB. III.

CALX carbonata primitiva.

Primitive crystallized Carbonate of Lime.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized.

Syn. Chaux carbonatée primitive. *Haüy, v.* 2. 132.

Upper figures. We believe these small crystals represented on the piece of pyritaceous coaly substance, are the true nucleus or primitive crystal of carbonate of lime, having measured them as well as we could. It appears to be a rare thing at present to find them so perfect in Britain.

Those that are larger are either foreign or partaking of the pearly lustre belonging to the *Sidero Calcite* of Kirwan, *v.* 1. 105. *Chaux férifère, Haüy, v.* 1. 175. The line of separation is hardly discernible.

Lower figures. The fractures in the mass afford an excellent help to discern these as little flat primitives; those detached agreeing with the fractures of the flat mass. These,

although perhaps not before noticed, may commonly be found in thin layers, or separate in the small partings in the Newcastle coals, from nearly pellucid to nearly opaque white, not unfrequently prismatically coloured, or coated with silvery or golden coloured pyrites, and may sometimes be found very beautiful. Wishing to make the subject familiar, I felt a pleasure in introducing a thing so easily procured,

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TAB. IV.

CALX carbonata, *var.* inversus.

Crystallized Carbonate of Lime, inverted.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized.

SYN. Chaux carbonatée inverse. $E^{1}\,{}^{1}\underset{f}{E}$. *Haüy*, *v.* 2. 183.

THE upper figure is a curious specimen of crystallized carbonate of lime, with the faces of the rhomb in the inverse order to the laminæ of the nucleus, and their angles so near to those of the primitive, over which it is formed, as to look like the same, differing only in one degree: 102° 30′, 77° 30′. This is from Pwll-y-cochan, near Conway, Carnarvonshire, out of a lead and blend mine. It is stained probably with oxid of iron. The edges are more transparent and shining than the other parts. The rest of the mass or matrix is crystallized in primitive rhombs, mingled so confusedly that it is not readily perceived without breaking; when they are found very regular.

When we use the term *Calx carbonata*, it means crystallized carbonate of lime.

The lower figure is from the summit of Moel y hiraddwg, a lofty hill bounding the vale of Clyde, and was sent me by D. Pennant, Esq. F.R.S. F.L.S. with some nearly like the above. This is a specimen of a more confused crystallization, the red oxid being very abundant. The crystallized parts are separated in irregular columns of a romantic appearance: the little white strata at the bottom have settled between the red ones in a curious manner. The fracture is irregular, depending on the confused laminæ, the light falling on the flat sides of which occasions a shining lustre.

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TAB. V.

CALX sericea.

Satin Spar.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 2. Imitative.

My friend the Rev. Mr. J. Harriman first favoured me with a piece of this curious mineral, about the year 1797. It was then recently made known to the mineralogical world by Mr. Stag, who sent me a piece soon after. It is understood to have been discovered about ten years ago, about a mile from Alston in Cumberland, washed by the river Tyne, near the level of its bed, and no where else at present. The spot is about 30 yards long and 10 yards wide; the middle producing the broadest stratum, which was about 4 inches, soon narrowing and becoming full of veins. I was told it was a very pure carbonate of lime soon after I received it, although it was kept a secret where it was found.

The colour is white, with a beautiful satiny lustre, showing the strata broad in the light and shade, and innumerable in the intermediate space, varying as they are directed to the light, which is best if perpendicular to them. It transmits light at the edges, or in thin pieces. The fracture in the direction of the striæ is fibrous, straight (perhaps with im-

perceptible undulations, whence the lustre), or crooked *, somewhat jagged, with a few flattish fragments. The cross fracture is nearly at right angles with the striæ, with a compact splintery dull surface, seldom in the direction of the strata, which are rarely quite at right angles with the striæ. It is much of the same hardness with the crystallized carbonate of lime, does not scratch with the nail, is brittle, and breaks most readily in the direction of the striæ.

Mr. H. Pepys junior seems first to have described this mineral in the Philosophical Magazine, vol. 12. p. 364; and according to his analysis it contains,

Carbonic acid - - - -	47·600
Lime - - - -	50·080
† Iron - - - -	012
Loss or water of crystallization -	2·308
	100·000

Spec. grav. 2·709 to 2·721.

It has been formed into snuff-boxes, and turned into studs, which look very pretty.

The blackish clay and metallic lustre of the pyrites give it a pretty relief; the top is an example of a septarium of some authors. The rosy blush is a very dilute iron stain.

* I have a specimen with the striæ curved like the Italic *ſ*, and the fracture nearly at right angles with every curvature.

† The iron need not be reckoned, as Mr. Pepys observed it was adventitious, pieces having been chosen quite free from iron.

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TAB. VI.

CALX stalactites.

Lime Stalactites.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 2. Imitative. *Haüy, v.* 2. 168.

SYN. Stalactite. *Kir. v.* 1. 88. *Born, v.* 1. 298.
Chaux carbonatée concrétionnée. *Haüy, v.* 2. 168.
Stalactites spatosum et Stiria. *Gmel.* 100.

STALACTITES, from their nature extremely various, are chiefly found on the roofs and sides of caverns, sometimes lining them in a very grotesque manner, hanging also very fancifully in the form of icicles, hollow or solid. They vary in colour like other carbonates of lime, and have a like fracture and nucleus to the crystallized ones.

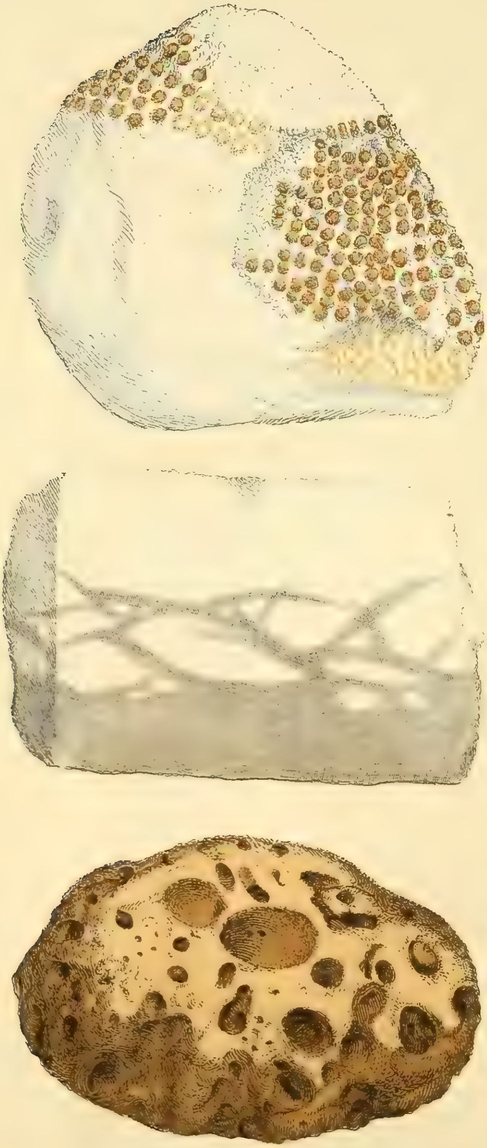
The left hand figure is part of a solid stalactite crystallized, with numerous ends of the rhomb lying together, giving an undulated appearance, and on the whole not unaptly resembling an unfolding bud. These are reckoned rare, and are found in a deep mine at Castleton, Derbyshire.

The upper middle figure is solid, oddly divided, of a whitish and somewhat waxy appearance, altogether of the crystallized fracture, some parts showing the solid angle of the nucleus. These are continually forming at Castleton in Derbyshire.

Right hand figure cylindrical, hollow, very straight and diaphanous, its outside smooth, inside crystallized in somewhat irregular spiculated rhombic forms. I was favoured with this very curious specimen from Stonesfield quarry in Oxfordshire, by Dr. Williams the botanical professor.

The brownish quill-formed stalactite, as the fistulose ones are often called, are common in many places. The darker sorts, somewhat resembling the middle one, are often found of various forms and dimensions. These dark ones may be coloured by clay. *Kir. v.* 1. 87.

The lower middle figure is mostly found of an opaque and chalky appearance in wet cellars on the roofs and walls. Lady Wilson finds them continually forming in a drain at Charlton house. The Rev. Mr. C. Sutton and the Rev. Mr. W. Kirby have favoured me with specimens found by them at Richmond and Kew. They occasionally occur in cellars in London, &c.



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TAB. VII.

CALX Creta.

Common Chalk.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 3. Amorphous.

Syn. Chalk. *Kir. v.* 77.
Craie compacte. *Born, v.* 1. 281.
Chaux carbonatée crayeuse. *Haüy, v.* 2. 166.
Creta scriptoria. *Linn. Syst. Nat. v.* 1. 206. *Gmel. v.* 3. 86.

Albion cliffs, famed of old, are the chalk-hills of Dover in Kent, and chalk is sufficiently known to abound in many parts of Britain.

There is no chalk in Cornwall*. Chalk is understood to be a precipitation of carbonate of lime, holding a little clay and some flinty particles. It is often in very thick strata, frequently under sand. Flints in strata and of irregular forms are very common in it, and sometimes flints full of flaws, as if mouldering to pieces. Thestratum is mostly horizontal, but sometimes otherwise, as at the Isle of Wight†. Many remains of animal exuviæ are found in chalk, as shells, echini, corals, &c. and with the rhombic fracture: sometimes the echinites are filled with perfect flints.

* Dr. Maton's Tour to the Western Counties.

† Sir H. C. Englefield in *Linn. Trans. v.* 6.

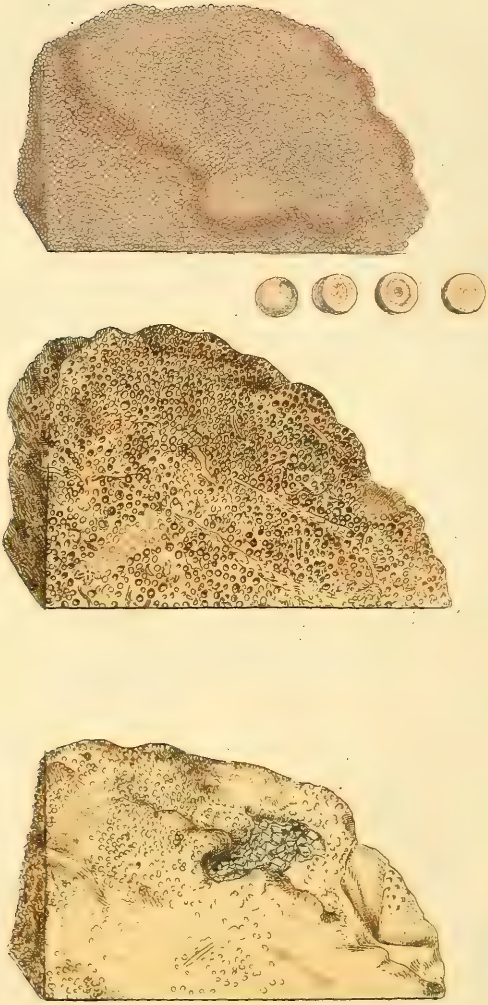
Martial pyrites, or sulfure of iron, is not uncommon in it, either in full metallic splendor, or in different states of decomposition passing into ochre or oxid of iron. It is remarkable that Mr. Kirwan, in his Geological Essays, p. 238, says that metallic substances are never found in chalk. *Werner Kal. Classif.* 19. *Berg. Kal.* 232. Yet in France martial pyrites are said to be found in it, 39 *Roz.* 358; as if it were not found in England. Pyrites are found in the chalk of Sussex; I have found them from Dover to Margate; at Godstone also in great abundance, where the chalk in various ways passes into fine-grained micaceous lime-stone called fire-stone, brought in abundance from Ryegate.

The upper figure is meant to represent a lump of chalk from Sussex, which has a conical fracture not uncommon in chalk, and sometimes in flint. The little granulæ of fine gravel so regularly formed about it, seem to be a filtration of water carrying sand with it through some loose chalk, which meeting with a more compact piece runs down the sides in drops, and at the same time is absorbed by the chalk, leaving the sand on the surface in little globules. There are sometimes large quantities of sand in the chalk which fall in occasionally, and are called by the workmen sand gulls.

Middle figure. Chalk passing into lime-stone, hardening with inosculating veins.

The lower figure represents a piece of chalk rounded by rolling about in the sea, perforated by the *Mytilus rugosus*, or some species of *Pholas*: being stained it loses the appearance of chalk. Harder substances are often perforated by testaceous animals.

Bryum calcareum, English Botany, t. 191, should seem to indicate good chalk, as I have found the best where it grows.



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TAB. VIII.

CALX petrosa.

Lime Stone.

Class 2. Earth. *Order* 1. Homogeneous.

Gen. 1. Lime. *Spec.* 1. Carbonate of Lime.

Div. 3. Amorphous.

SYN. Pierre à chaux commune. *Born, v.* 1. 284.

Kalxstein. *Emmerling, v.* 1. 437.

Compact limestone. *Kir. v.* 1. 82.

Chaux carbonatée grossière. *Haüy, v.* 2. 166.

LIMESTONE, generally speaking, is carbonate of lime, harder than chalk, often containing 10 or 12 per cent. of clay or iron. If so much as 15, Mr. Kirwan says it should be excluded, as scarcely affording good lime in burning.

Upper figure. Ketton-stone, found in abundance at Ketton in Rutlandshire. It is remarkable for its singular accretions in the form of fishes roe, whence it is often called

Roe-stone. It is used for building in many places: some of the colleges at Cambridge are built with it. The same uniform appearance extends to very large masses; and although a sound, strong and durable stone in the mass, very little pieces may be crumbled to grains by the fingers. The masons use a common carpenters saw in working it: the little rounded particles being easily detached, it passes readily through it. They sometimes have a little dusty or solid nucleus, coated concentrically; at other times are hollow. In the next county, Northamptonshire, there is a stone called by the masons Barneck, greatly resembling this, but coarser, containing shells, &c. Col. Walford found a stone of a similar nature with larger grains (which approaches the oviform limeſtone of Kirwan, v. 1. 91), at Birdbrook, Essex, mingled with shells, which has sometimes sufficient clay or argil to be called a marle.

Middle figure. Bath-stone, frequently contains the same concretions, but more decomposed, and a matrix surrounding them, somewhat confusedly crystallized, forming little hollows: many species of shells, encrini, &c. are found in it; sometimes however so comminuted as to be quite indistinct. I picked up a piece of stone at Burford in Oxfordshire, which is of a reddish brick colour, with the hollows very distinct, giving it a volcanic or cindery appearance. With difficulty very small pieces crumble between the fingers.

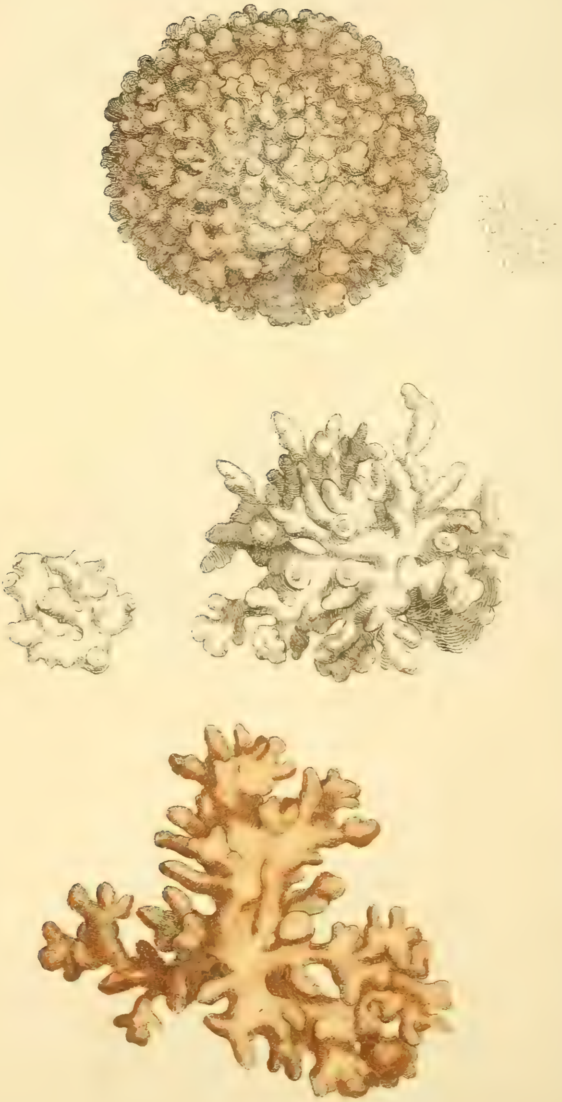
Lower figure. Portland-stone, nearly like the Bath-stone. The best sort is more compact, and whiter: there are many

varieties of it, paſſing into marly, flinty, &c. It often affords good crystals. The specimen figured had some little rhombs half relieved on it. A crystallization called, from its resemblance, sugar-candy spar is frequent among it. Shells of various kinds are often found in it. Sometimes it appears in the form of large trunks of trees, hardest within, resembling whitish chert.

Ketton-stone, colour light reddiſh brown, lustre 0.
Transparency 0.
Fracture earthy granular.
Hardness 5 or 6.

It contains 90 per cent. calx, and 10 of argil. The Bath and Portland nearly the same in most respects, but harder.

$$\text{Spec. grav.}\quad \left.\begin{array}{ll}\text{Ketton} & 2{\cdot}456\\ \text{Bath} & 2{\cdot}494\\ \text{Portland} & 2{\cdot}461\end{array}\right\}\ \text{Kir. v. 1. 88.}$$



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TAB. IX.

CALX coralliformis.

Coral-form Carbonate of Lime.

Class 2. Earth. *Order* 1. Homogeneous.

Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.

Div. 2. Imitative.

Ellis corallines, p. 76. *tab.* 27. c.

THESE curious chalky accretions are found plentifully in the loose marle at St. Maws, Cornwall, which abounds also with shells of various species, and is brought to Truro to be sent to different places for manure, being excellent for the adjoining lands. I have specimens from the Rev. H. Davies of North Wales. Their resemblance to corals has caused them to be mistaken for such; but on a careful examination, they are found to be only aggregations of calcareous earth, accumulated upon little nuclei, ramifying in the soft marle, and occasionally attracting other calcareous particles, which form fresh coats like the bark of a tree, and are not unlike the coats on the nuclei of the

Ketton stone lengthened out, as the broken ends plainly show. They vary extremely in their forms, and when large are sometimes perforated on the outside, apparently by some marine insects; which may have contributed to the idea of the whole being of animal construction. Nature ever allotting certain bounds to every species of her productions, permits them to separate from one another in many nice and curious ways. Thus calcareous earth in this instance is separating from the clay in the form of opaque branching corals; in others we shall find different modes of separation or division of calcareous earth and other substances.

The small specimens are very much branched, and mostly white, but somewhat softer to the touch. The larger are often more coloured with iron, perhaps some animal substance, as the place in which they are found contains many dead shells. Sometimes they contain some salt, which is readily perceived by the taste, and remains after drying in the cabinet. Some have no saline taste.

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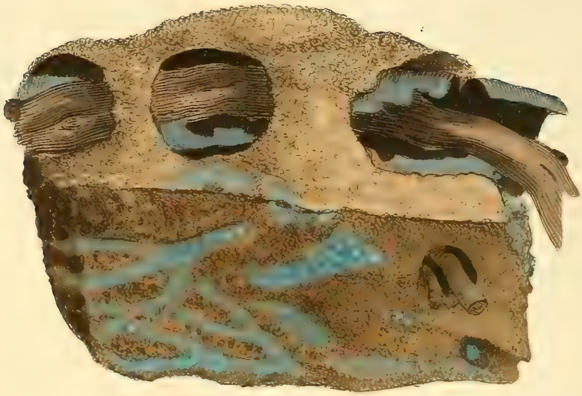
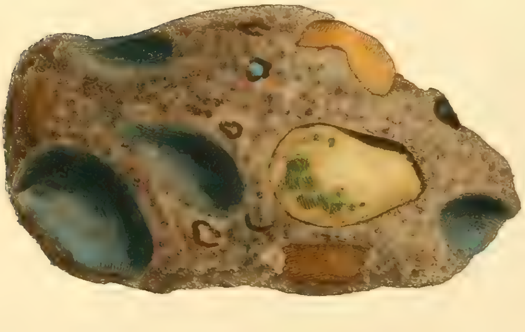




TAB. X.

FERRUM cæruleum.

Azure Iron Ore.

Class 3. Metals. *Order* 1. Ductile.
Gen. 8. Iron. *Spec.* 7. Azure Iron Ore.

Spec. Char. Contains sulphur ? and iron.

Syn. Blue martial earth. *Kir. v.* 2. 185.
Blau eisenerde. *Emmerling, v.* 1. 359.
Fer azuré. *Haüy, v.* 4. 119.

This is very common in marshy grounds at different depths in most parts of the united kingdom.

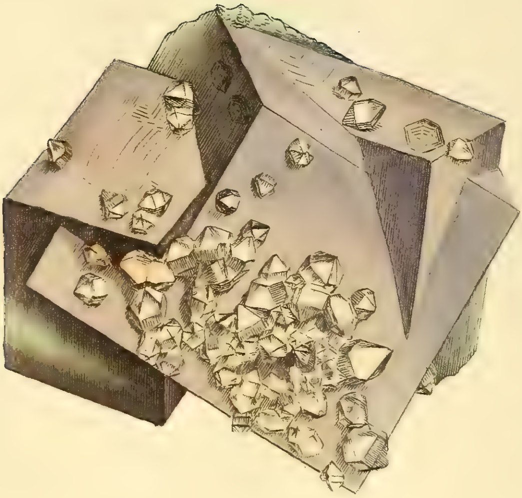
The upper figure represents some as found at Blackwall, or the Isle of Dogs, where great abundance was met with about four feet deep, in a sandy loam, mixed with roots and other vegetable remains. At the depth of about nine feet, in some places, it was mixed with a black clay, turf, leaves, hazel-nuts, &c. It occasionally exists among earth with the remains of shells, and is common in marshy places without any appearance of vegetable. I found some once on the shell of the *Mytilus anatinus* in Hyde-park, and have had it sent me from Scotland.

The lower figure represents it as found near Kennington and Lambeth, where it is common about a foot under the roads in a dirty gravelly soil, partly hardened and approaching to what is commonly called pudding-stone. It adheres to the pebbles, but more particularly to the hollows where they have been. In endeavouring to ascertain the nature of this substance, we exposed some of the purest of the first sort to a gentle heat, which soon deprived it of the blue tint, emitting a sulphureous exhalation, with a blueish flame, and left a dark ochry brown substance, which proved to be an oxid of iron. We could not detect any prussic acid by the usual method.

Mr. Kirwan says, its colour, in its native situation, when not exposed, is white. This may sometimes be the case, but ours was blue even when fresh gathered and first broken.

Lustre none. Fracture dusty, of the upper figure; earthy and compact in the lower. Water does not change the colour; oil darkens it.

Klaproth thought this mineral contained phosphorus, but Mr. Kirwan thinks "the inflammability of this substance must proceed from some other principle, most probably carbon, perhaps an astringent substance."



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TAB. XI.

CALX Fluor, *var.* cubica.

Fluate of Lime, Cubic.

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 4. Fluate of Lime.

Div. 1. Crystallized.

Spec. Char. Lime combined with fluoric acid, which acid has the peculiar property of dissolving siliceous substances, or flint.

Chaux fluorée. *Born, v.* 1. 355.

Fluss. *Emmerling, v.* 1. 515.

Fluor. *Kirwan, v.* 1. 124.

Chaux Fluaté cubique. *Haüy, v.* 2. 247. $\underset{1}{A^{1}}\ \underset{i}{A^{1}}$

Fluor is divisible into regular octaëdrons. Spec. grav. 3·0943 to 3·1911, and according to Haüy has a regular tetraëdron for its integrant molecule. It is mostly found crystallized in cubes (more rarely in octaëdrons and their modifications) in many parts of Great Britain, as Derbyshire, Cumberland, two places in Scotland*; also in

* Aberdeenshire and Shetland. *Jameson, v.* 1. 151.

Devonshire and Cornwall. It may be fused by the blow-pipe into a transparent glass *. Its refraction is single. The powder projected on a hot poker gives a phosphorescent light, of a bright and glowing purplish or lilac colour. The Rev. Mr. J. Dalton favoured me with some from Cumberland, greenish within, and of a dull pale crimson on the outside, which gives this glow in great perfection, in rather large pieces, without cracking or dispersing so soon as usual; and if not too much heated, the same pieces will do again. In this it agrees with the chlorophane of Siberia, which much resembles it in external appearance, but gives a verditer green glow on exposure to heat without falling to pieces.

The fluoric acid was discovered by Scheele. It may be disengaged from the lime by means of dilute sulphuric acid, and has been used for etching on glass. One of the methods may be acceptable to my general readers. Having a plate or piece of glass thinly covered with wax, etch, or draw, by cutting through the wax with a point or needle whatever may be desired, placing the glass horizontally, so as to retain the fluid, (it may be best perhaps to surround the plate with a wall of wax, for the greater security); then having some fluor pounded to a fine dust, sift or spread it over the whole within the waxen wall. Mix one part of sulphuric acid to two or three of water, and pour it on gently. The strength of the strokes will depend on the quantity of dust of fluor, and the strength of the acid

* It is apt to crack and disperse; which may be prevented by powdering it.

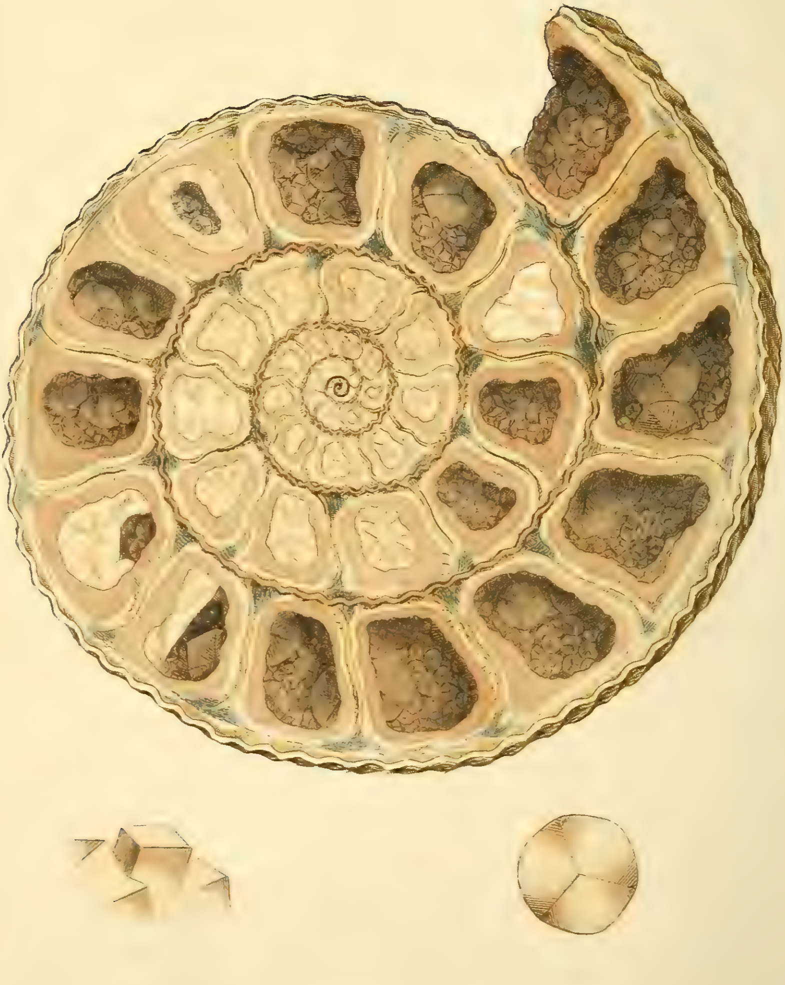
that is to decompose it. Very little practice will show the proper strength of the ingredients to corrode a certain depth in the glass, where the strokes were drawn. The rising fumes will etch another prepared glass, if placed so as to receive them, and perhaps more regularly. The acid for chemical purposes is commonly procured in a leaden apparatus.

I have figured two specimens of the most common appearance of fluor. The upper one deviates a little in form, the middle cube being interrupted by the side ones, contracting its upper part, so that the lower is much the broadest. There are some crystals of what is commonly called eighteen-sided quartz sticking about them, as usual with fluor from Cumberland.

The lower figure seems altogether of a fine deep purple, but is only thinly coated, the inside being of an olive green. The faces are remarkable for having signs of the laminæ of superposition, indicating four-sided pyramids, the apex of which appears at the edges of the cubes where in contact.

Fig. 1. shows a corner of one of the cubes replaced by six minute triangular facets.

The upper figure has some signs of superposition, though scarcely more than scratches, giving the specimen a greasy appearance. The hexangular cavity is where a crystal of quartz had stuck, and shows that the side inserted was not regular: hence it appears that the crystals of quartz are not regularly eighteen-sided, their shape being interrupted by the fluor.



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TAB. XII.

CALX carbonata, *var.* equiaxi-lenticularis.

Crystallized Carbonate of Lime, lenticular-equiaxed.

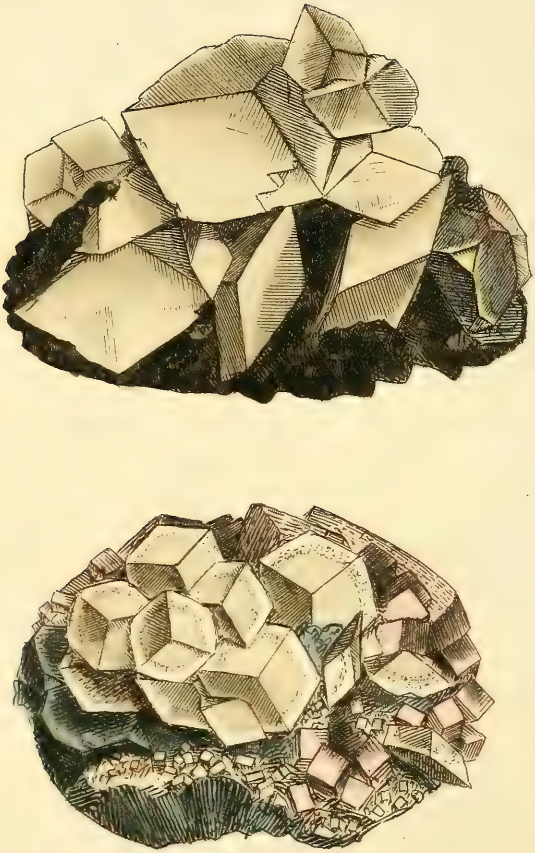
Class 2. Earth. *Order* 1. Homogeneous.
Gen. 2. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized. *Var.* 1. Equiaxed.

THE figuring of this shell will not only serve a geological purpose, and show a curious crystallization, but help to explain the flattened crystals in the next plate, which are not easily understood, as the lines they form in the drawing give but little idea of flatness, and may seem to express the perspective of a cube, especially as we are not yet much accustomed to these representations.

This is the *Helmintholithus Ammonites* of *Linn. Gmel. v.* 3. 411. usually called Cornu-ammonis, of which there are many species found in the petrified state *, abundant in

* This species and many others are found only in this state, never recent.

many parts of Gteat Britain. Abroad they are often siliceous, or at least contain siliceous crystallizations; but in Great Britain are mostly calcareous, found in lime-stone rocks and marly places. The shelly part may some of it be the remains of organic structure. The crystallized internal parts of shells and stones afford a curious subject for inquiry. In the chambers of this nautilus, (for so the living genus is called by Linnæus, see Gmel. v. 1. 3369., the matter of crystallization may have passed through the alveolus, or little hole, to each partition. In other shells, and in *geodes*, it must be otherwise. The crystals are rough, and in nearly a regular series from the primitive to the equiaxe. The faces however of the latter are rounded, giving it a lenticular form. They are also somewhat striated, resembling the lenticular crystals of certain spathose iron ores.



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TAB. XIII.

CALX carbonata *var.* æquiaxis.

Crystallized Carbonate of Lime, var. *equiaxed.*

Class 2. Earth. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized. *Var.* 1. Crystal Equiaxed.

SYN. Chaux carbonatée équiaxe. $\overset{B}{\underset{g}{1}}$. *Haüy, v.* 2. 132.

THIS crystal is formed of six rhomboidal faces the angles of which are 114° 18′ 56″, and 65° 41′ 4″, forming a very obtuse rhomb, the axis of which is equal to that of the rhomb which it encloses. *Haüy, v.* 1. 133.

These and their modifications are found plentifully in Durham and Cumberland, according to specimens sent me by the Rev. Mr. Harriman and Mr. Oliver. I have had fine specimens from Newcastle by favour of Mr. Woodhouse, found in coal mines. They occasionally occur wherever other calcareous substances are found.

The upper figure is part of a fine specimen with clearer crystals than usual, for they generally incline to a milky

hue. They frequently stand on their edges, or are as it were thrown about in different directions, on various matrices. This is on dark or gray lime-stone, with blend* and galæna†. The first is confusedly crystallized, which commonly happens; the latter more regularly so, in cubes with the corners truncated, or a cubo-octaëdron, as Haüy rightly terms it.

The lower figure has smaller crystals, roughish towards the edges, as if not quite finished. The roughness proceeds from the edges of the molecule, or from spaces where there seems something wanted to finish the faces and make the surfaces even. The crystals are somewhat striated towards the centre, and are loosely fixed among light purple fluor and galæna.

* An ore of zinc called by the miners black jack.

† An ore of lead.

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TAB. XIV.

ARGILLA Marga.

Argillaceous Marle.

Class 1. Earth. *Ord.* 2. Mixed.
Gen. 5. Argil*. *Spec.* 1. Argillaceous marle.
Div. 2. Semi-indurated.

SPEC. CHAR. Argil and carbonate of lime, in which the former predominates.

SYN. Marga argillacea. *Waller, v.* 1. 72.
Mergel. *Emmerling, v.* 1. 491.
La Marne. *Brochant, v.* 1. 569.
Argile calcarifère. *Haüy, v.* 4. 455.

THIS is represented as showing the distinguishing characters, or parts, of marle, which, if minutely combined, might require a chemical analysis to determine them; and may be useful to young mineralogists. Calcareous marle consists of carbonate of lime from 66 to 80 per cent. *Kir. v.* 1. 94. Marle properly so called consists of equal parts of clay, and carbonate of lime. Argillaceous marle contains about three parts clay, and one chalk. *Mr. Andreas, in Kir. v.* 1. 192.

* Common clay, which may be distinguished under most combinations by what is commonly called an earthy scent.

The present specimen, given me by Mr. Pilkington, F. L. S., was found about 190 feet deep, in digging a well for Lord Redesdale, now C. Poole's, Esq., at Streatham, Surry.

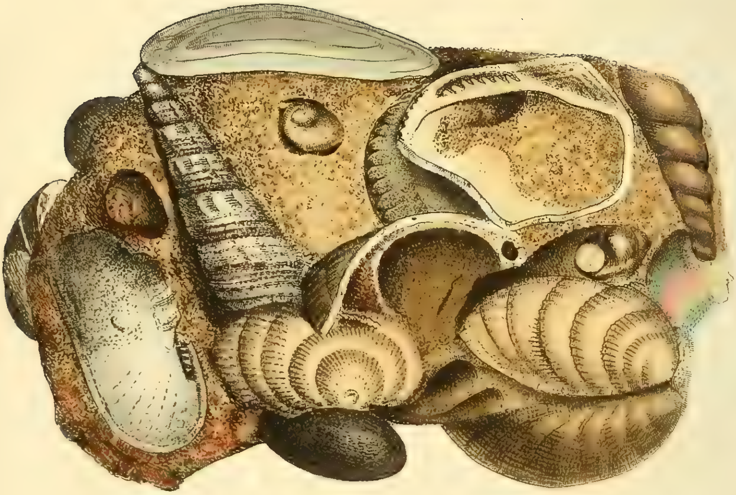
It is of a semi-indurated toughish texture, but readily falls to pieces in a damp atmosphere. The clayey parts are evidently mixed with carbonate of lime, and some of the shells are little else, although they retain their original figure so well that we may distinguish some of the species*. The pearly oyster shells only seem to have assumed a black tinge. The other pearly shell, perhaps *Arca Nucleus, Linn. Gmel. v.* 1. 3314. retains its original lustre, its gluten being less easy to decompose†. There are other pearly shells in the mass, but not easily to be made out. The clayey-looking part does not effervesce with vinegar, neither do the pearly shells. The chalky ones readily do. Marles depending on their proportions of lime, clay‡, or sand, are used as manures, each sort being adapted to the nature of the land they are applied to.

One kind of marle has lately been found to be a useful stucco, when properly prepared.

* These, on breaking the mass, leave half their substance on the convex side of the matrix, and the other half in the mould.

† See Mr. Hatchett's ingenious paper in Philosophical Transactions for 1798.

‡ Clay must be understood as a mixture here of argil, silex, and iron.



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TAB. XV.

SILEX arenacea, *var.* calcarea.

Calcareous Sandstone.

Class 2. Earth. *Ord.* 2. Mixed.
Gen. 6. Silex. *Spec.* 2. Combined with calcareous Earth.
Div. 2. Semi-indurated.

SYN. Calcareous sandstone. *Kir. v.* 1. 361.

MASSES of this, from about 8 inches to 2 feet thick, were found at near twelve feet deep in a light gravelly stratum, in cutting the canal at the Isle of Dogs. The decomposing shells have apparently undergone a change, by means of subterraneous heat causing them to combine with the sand and pebbles. Some of the shells I believe are new to Great Britain, both in the natural and fossile state. These are the gibbous *Arca*, at the lower corner on the right hand, the hinge and cockle-like edge of which are seen distinctly above it; the oblong *Arca* resembling a *Mytilus*, on the left side, showing part of the hinge, which I have not seen in any other specimen. The decomposition of this shell, and the *Turbo* near it, are more chalky than the others. The oblong

oyster shell at the top retains its pearly lustre. Other shells have only left their impressions or cast. Some of the pebbles are cracked with the heat, and their interstices filled by calcareous matter.

The whole forms a calcareous sandstone, with very little variation, and is of a pale brown colour*. The parts being distinct, it forms an instructive specimen, and will serve to explain more obscure ones.

* Sometimes with a darker tint of yellow, and occasionally of a smoky black, especially where wood is found with it.

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TAB. XVI.

ARGENTUM capillaceum.

Capillary Silver.

Class 3. Metals. *Ord.* 1. Ductile.
Gen. 3. Silver. *Spec.* 1. Native Silver.
Div. 2. Imitative.

GEN. CHAR. The whitest of all known metals, very malleable, and sonorous; specific gravity before hammering, 10·474; after, 10·510. Dissolves readily in nitric acid, and may be precipitated from it by copper, iron, or zinc. Remains in fusion at 28° of Wedgewood, but requires a greater heat to fuse it.

SPEC. CHAR. Ductile with but a small proportion of alloy.

SYN. Argentum nativum. *Waller*, *v.* 2. 328. *Linn. Syst. ed.* 12. *v.* 3. 148.
Native silver. *Kirwan*, *v.* 2. 108. *Bab.* 146.
Gediegen silber. *Emmerling*, *v.* 2. 153.
Argent natif. *Haüy*, *v.* 3. 384.

IN June 1799, soon after the discovery of native silver in the Herland copper mine, in the parish of Gwinear, about 7 miles from St. Michael's Mount, I had the pleasure of

calling there in company with my friend D. Turner, Esq., and was lucky enough to procure some rich little pieces, which served my purpose, and gave me the most satisfactory pleasure of gratifying a few friends. According to the Rev. Malachi Hitchings's account, in Phil. Transac. for 1801, page 169, " the lode in which it occurs is one of those cross courses which intersect and derange the copper lodes, and are consequently of a more recent formation. No ores of silver were observable in this lode till at the depth of 110 fathoms from the surface, and at the further depth of 32 fathoms they disappeared. The richest mass of silver ore was found at the depth of 2 fathoms above the level at which it disappears. About 108 tons of it are said to have been raised. The silver ore, strictly speaking, is a mixture of galæna, native bismuth, gray cobalt ore, vitreous silver ore, and native silver."

Our specimen seems to be the galæna decomposing and protruding the silver; itself remaining of a cinereous appearance, losing its natural brilliancy. There are also some pyrites and bits of quartz. The silver protruded is nearly pure, and has been (from its curling appearance) compared by the people of Penzance to the scrapings of silver spoons. The silver for coin and manufacturing is alloyed with copper, which does not affect the whiteness, and is not easily detected, unless in too great proportion, when it may sometimes be tasted. It may be made very thin as leaf silver, one grain thus formed measuring more than 51 square inches. It is often used to plate over copper or iron, and

wire so made serves for musical instruments, &c. A wire one tenth of an inch in diameter will support 270 pounds weight.

Silver, by being dissolved in nitric acid, and precipitated with mercury, will form the likeness of a tree, and is then called Arbor Dianæ.—If precipitated from the nitric acid by lime water, the precipitate dried, and washed with a solution of pure ammoniac, has a dangerous fulminating property; and on the slightest touch, or friction, will explode most violently, exceeding the force of gunpowder. The nitrate of silver stains animal substances a deep black, and has been used to blacken human hair; but it is extremely dangerous, owing to its corrosive property.

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TAB. XVII.

CUPRUM dendriticum.

Dendritical Copper.

Class 3. Metals. *Ord.* 1. Ductile.
Gen. 4. Copper. *Spec.* 1. Native.
Div. 2. Imitative.

Syn. Cuprum nativum. *Waller, v.* 274. *Linn. Syst. ed.* 12. *v.* 3. 143.
Gediegen kupfer. *Emmerling, v.* 2. 206.
Cuivre natif. *De Lisle, v.* 3. 305. *Haüy, v.* 3. 518.
Native copper. *Kirwan, v.* 2. 128.

Not uncommon at the Lizard and other places in Cornwall, in the crevices of quartzose rocks, or in serpentine, and is occasionally found in North Wales, &c. It accommodates itself n all directions to the smallest openings, ramifying, or inosculating, as in the specimen figured, or forming network. It is generally so compressed as to have the impression of the stone on the surface, giving breadth to the extremities, not unaptly resembling foliage, which is often helped by the tendency of the metal to crystallize. This it always partly does, but in so confused a way that it can only be understood by comparison with such specimens as have had more

room to crystallize. This will be readily understood by the figure of what I have called Arborescent Copper.

Copper is so well known in Great Britain as scarcely to need a description. The fresh fracture is very hackly, mostly brighter, and lighter in colour, than the outside, which is often stained or cankered. It is however sometimes found so pure, or bright, that it changes but little; and the fracture will hardly show a difference of colour, if carefully kept. Hardness 6—8, *Kirw.* Steel cuts it neatly, whence it is made into plates for engraving on. It is soluble in acids; and aquafortis is used by artists to etch upon it with the help of wax, not unlike the operation spoken of under the article Fluor, tab. xi. of this work. It is manufactured for many purposes, as common coin and kitchen utensils, but is not now so much used for culinary purposes as formerly. It forms a compound metal with tin and zinc, called brass. It is readily drawn into wire, which is very tough and durable. A wire one-tenth of an inch in diameter will sustain 299½ pounds weight.

[illegible] 180[illegible] Published by Ja.s Sowerby London

TAB. XVIII.

STANNUM oxygenizatum.

Oxygenized Tin.

Class 3. Metals. *Ord.* 1. Ductile.
Gen. 8. Tin. *Spec.* 2. Native oxide.
Div. 1. Crystallized.

GEN. CHAR. Nearly as white as silver, malleable, ductile, and sonorous in a small degree, flexible, but with a crackling noise. Spec. grav. only 7·063 to 7·331. Smell unpleasant. Fuses at 410° Fahrenh. Not soluble in nitric acid.

SPEC. CHAR. Tin united with oxygen.

SYN. Common tin stone. *Kir. v.* 2. 197.
Zinnstein. *Emmerling, v.* 2. 421.
Etain oxydé. *Haüy, v.* 4. 137.
Stannum crystallinum. *Linn. Syst. ed.* 12, *v.* 3. 130.

TIN, although universally known in the metallic state as obtained from its ore, would never be recognizable without experience in the crystallized oxide, from which it is chiefly procured. This crystal was once thought, by the Cornish miners, to be destitute of metal. The tin mines of Cornwall are the most famous in the world, and were very early known. The Phœnicians procured this metal from thence.

The Cornish tin ores are said to be the most pure, as they contain less iron and arsenic than those of Bohemia, Saxony, &c. The crystals are mostly confused : specimens however are sometimes found (and preserved to gratify the curious) which are very distinct and beautiful. They resemble bottle glass; are mostly of a black hue, approaching a brownish horny lustre; sometimes brighter, and with a fiery sparkling, varying to red, gray, or whitish. The crystals are the cubic or octaëdral modifications: the perfect cube has never, I believe, been found. The octaëdron, I am told, is perfect in the Honourable Mr. Greville's collection. I have one nearly so. They often press against each other, forming macles, &c. This ore is found varying, sometimes amorphous, in the quartzose, decayed granite, or growan, killas, and other rocks: also in streams, and is then called stream tin. It occurs also in pebbles, and sandy particles. A rare species, called wood tin, or tin hæmatites; also another called tooth tin, and sulphuret of tin, are found in different parts of Cornwall. There is very little tin in Devonshire, and none in any other county of Great Britain.

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TAB. XIX.

CALX carbonata, *var.* margaritacea.

Pearl Spar.

Class 2. Earth. *Ord.* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of lime.

Div. 1. Crystallized, crystal primitive.

Var. With some iron and manganese. Lustre pearly; crystals often curving.

Syn. Sparry iron ore. *Kir. v.* 2. 190.
Spathiger eisen stein. *Emmerl. v.* 2. 329. *Werner.*
Chaux carbonatée férifère. *Haüy, v.* 2. 175.
Pearl spar. *Bab.* 18.

Having so distinguished an appearance from other carbonates of lime, this has obtained the name of pearl spar, a name it naturally suggests, and by which it is in general easily recognized. We find however, like other subjects in nature, it has its gradations, and consequently blends itself with substances to which at first it seems very little allied. It may be readily traced, as formed from the primitive crystal of carbonate of lime, to an iron ore, consisting for the greater part of oxide of iron, and manganese. The progress, if I may so call it, appears curiously and distinctly marked by the manner of the crystals, which are in the forms of the primitive rhombs, and are white: sometimes however it approaches the appearance of ivory; and as its substance

becomes pearly, the nuclei seem to be separating and curving from about the angle of 30° to about 20°; see the figures. They mostly appear of the natural pearly lustre, but are often at length more curled and darkened, and thence may be called spathose iron ores: perhaps they may be called iron ores whenever the common browner aspect seems to indicate as much. Those, however, which have the forms and fracture of crystallized carbonate of lime may be placed as such while they retain the whitish pearly lustre.

Pearl spar analysed by Bergman contains

Lime	38
Oxide of iron	38
Oxide of manganese	24
	100

By Wolf,

Carbonate of lime	60
Oxide of manganese	35
Iron	5
	100

By Berthollet,

Carbonate of lime	96
Oxide of iron and manganese	4
	100

Thus different analyses, showing a difference in the proportion of the substances of which it is composed, decide it to be more or less an iron ore.

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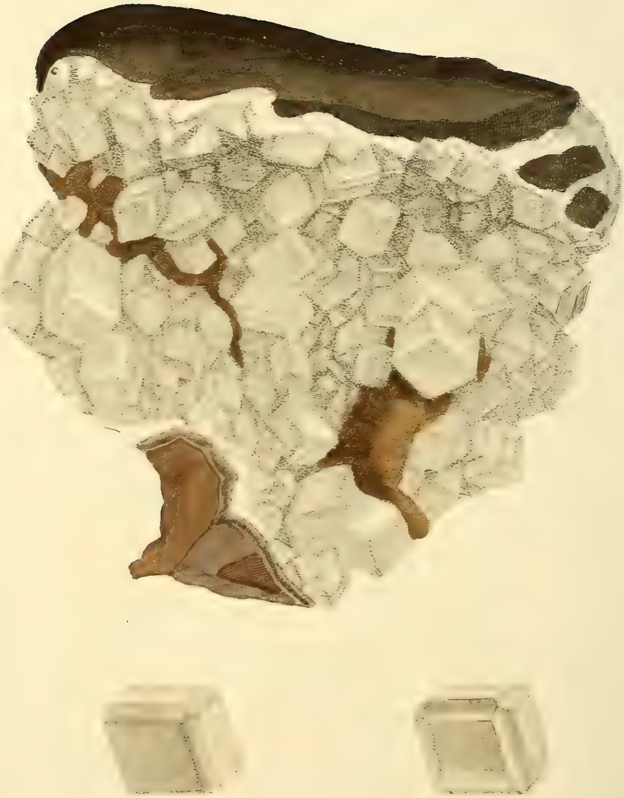

Ja.s Sowerby London

TAB XX

CALX carbonata primitiva, *var.*

Primitive Carbonate of Lime, var.

Class 2. Earth. *Ord.* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of lime.

Var. Crystal primitive, with secondary faces parallel to both those of the equiaxed and metastatic.

THIS curious crystal is sometimes found at Castle-Town in Derbyshire. Its gangue is generally a bituminous limestone. It is a little milky on the outside, and roughish; those edges excepted which are rounded: see the left-hand figure. The right-hand figure has broad faces leading to the equiaxed crystal, which faces are as it were polished, and in the middle is a longitudinal line showing the edge of the nucleus, consequently the laminæ of superposition: see the upper part of the right-hand figure. There are also rough faces leading towards the metastatic crystal: see the lower part of the right-hand figure. As I had but indifferent specimens myself, I borrowed the specimen here figured of Mr. Richard Phillips, thinking it well worth noticing. The little black spots are drops of mineral pitch, which mostly accompany these varieties. They have generally been termed primitive crystals, without further consideration. In an arranged collection they may be placed near to the primitive.

[illegible]

CALX carbonata primitiva, var.

Primitive Carbonate of Lime, var.

Class [illegible] Earths. Ord. [illegible] Homogeneous.

Gen. 1. Lime. Spec. [illegible] Carbonate of Lime.

Var. Crystal primitive, with [illegible] parallel [illegible] three of the [illegible]

This cubic crystal is sometimes found at Castle-Town in Derbyshire. The gangue is generally [illegible] stone. It is a little [illegible] on the [illegible] three edges excepted which are [illegible] figure. The [illegible] figure has [illegible] tending to a [illegible] which [illegible] and in the middle is a longitudinal [illegible] the [illegible] of the nucleus, [illegible] upper [illegible] figure [illegible] are also [illegible]

[illegible] figure. A [illegible] specimens [illegible] black [illegible]

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TAB. XXI, Upper Figure.

CALX sulphurata; *var.* plumosa.

Sulphate of Lime; var. *plumose.*

Class 2. Earth. *Ord.* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 5. Sulphate of lime.
Div. 2. Imitative; *var.* plumose.

Syn. Sulphate of lime forming snow-white incrustation, &c. *Bab.* 29. ccxvi, a, 1.
Chaux sulfatée niveforme*. *Haüy*, 2. 279.

The *upper figure* is a curious variety of sulphate of lime, or gypsum, from Matlock. It should seem that sulphur of iron or pyrites, by exposure to damp, decomposes; the sulphur combining with oxygen forms sulphuric acid, which comes in contact with the lime in the rock, and so forming gypsum, oozes out in these fanciful forms; or, in other words, readily produces gypsum more or less crystallized. It is continually forming in many parts of England. Lord Altamont obligingly sent me some nodules of pyrites, in

* A variety found at Montmartre.

which gypsum is formed, from a well just dug in Cambridge. It is continually crystallizing from the sulphur of pyrites and oyster shells at Shotover Hill, near Oxford.

The *lower figure* is on a piece of limestone with a fœtid odour, called stinkstone, the gypsum spreading in a very peculiar manner on the surfaces in patches. I was favoured with this from the neighbourhood of Durham, by the Rev. John Harriman.

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TAB. XXII, Upper and Middle Figure.

SODA muriata.

Muriate of Soda, or *Common Salt*.

Class 1. Inflammables. *Ord.* 2. Mixed.
Gen. 4. Soda. *Spec.* 2. Muriate of Soda.
Div. 1. Crystallized.

Gen. Char. Soda in combination.
Spec. Char. Soda combined with muriatic acid.
Syn. Common salt. *Kirw. v.* 2. 31.
Common salt, sea salt. *Bab.* 14.
Stein salz. *Emmerl. v.* 2. 19.
Soude muriatée. *Haüy, v.* 2. 356.
Muria montana. *Linn. Syst. ed.* 12. *v.* 3. 98.

Found in abundance at Northwich in Cheshire, where it constitutes very solid strata, more or less mixed with common clay, giving it a dirty hue, or with yellowish or red calx of iron. Its large square crystals are often so transparent and clean as to appear uncontaminated. The miners leave pillars of it to support the roof; and when they show this grotto, they are proud to surprise the spectators, and add lustre to the scene by the display of many lights.

The *middle figure* shows the fracture to be cubic, and also some clear pieces lying among the coloured kind. I have none approaching the octaëdron or the cubico-octaëdron, see Haüy; nor do I know that it is found so in Great Britain.

Salt in sufficient quantity preserves animal substances from putrefaction, but too little is said to promote it.

Lustre 2 or 3, glassy. Transparency 2, 3, or 4. Hardness 4, 5, or 8. Spec. grav. 2,143. *Brisson.* Soluble in little less than 3 times its weight of water, at the temperature of

60. *Kirw.* Refraction single. Salt in the artificial way of preparing it, if crystallized hastily for use, has the centres of the cubes concave, or depressed, as it were, step by step from the edges, forming a curious figure. This is not uncommon in what is called rock salt, which is often brought to our tables in preference to basket salt; so called from being sold in fine grains, and pressed into conical baskets. Common salt is also used for glazing common earthen ware. 100 parts of this salt contain 35 of soda, and nearly 40 of muriatic acid, the rest being water. *Kirw.* 2. 33. Soda is an ingredient best procured from common salt. It is otherwise procured from sea plants. Soda not being found native in Great Britain, I take occasion to speak of it in this place. It is useful in making glass, and has lately been much used in common washing; often indeed so indiscreetly as to rot the linen, and even to act as Hercules's poisoned shirt, particularly to the tender skin of infants. Mothers will do well to be assured of their linen being well rinsed in plenty of cold water.

TAB. XXII, Lower Figure.

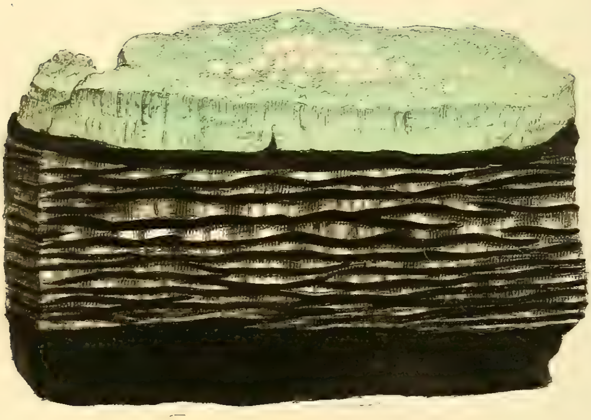
SODA fibrosa.

Fibrous Muriate of Soda.

Div. 2. Imitative.

Fibrous salt may be found of different shades of white, red, or brown, depending either on common clay, or on oxide of iron. This specimen has a piece or two of common clay in the centre. Its fibrous part is coloured by a red oxide of iron. This sort of specimen has been compared to wood, the curvature of the fibres and the fracture corresponding to that fanciful idea. Some have thought the red kind here figured resembled muscular fibres.

23



TAB. XXIII.

FERRUM sulphuratum.

Sulphate of Iron.

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 6. Sulphate of Iron.
Div. 1. Crystallized.

SPEC. CHAR. Sulphuric acid combined with iron.
SYN. Vitriol martial. *De Lisle*, *v.* 1. 331.
Sulfate de fer. *De Born*, *v.* 2. 39.
Vitriol vert. *Daubenton*, 28.
Vitriol of iron. *Kirw.* *v.* 2. 20.
Fer sulfaté. *Haüy*, *v.* 4. 122.
Vitriolum martis. *Linn. Syst. ed.* 12. *v.* 3. 104.

GREEN vitriol, as it is commonly called, is found crystallized, stalactitical, or in amorphous lumps, in many parts of Great Britain. The present is a curious specimen from Hawkshead coal mine, near Glasgow. It appears by a note sent to Mr. Vansittart with this and some other specimens which I had the pleasure of receiving from the Rev. Dr. Beeke, that the mine had been worked for above 200 years, from the *crop* to the *dip* (as the colliers term it), that is, following the descent from where it appeared on the surface, always working at the lowest part. Thus the upper parts, or pits, first worked were necessarily kept free from

water, and were left exposed to the external air above the coal stratum. The black clay, or aluminous ore, being the cieling of the mine, absorbed the oxygen in the common air by means of the sulphure of iron, (which is almost imperceptibly mixed with it,) in such abundance as to expand it, first in the form of white silky threads, merely separating the laminæ in a somewhat undulating form, but afterwards expanding it in such a manner, that the whole stratum, which was but 14 inches, sometimes became a yard in thickness falling to the floor; and the threads, from being scarcely perceptible, become near an inch long, curling in many fanciful directions*. It sometimes ripens or consolidates into what the workmen call native copperas, and may possibly hold a little copper. It is somewhat crystallized, like the green part figured, upon the clay or alumine, which is in the act of throwing out little white opaque round spots, the effect of a further change since the specimen was in my possession. These probably contain less water than the other parts.—Its transparency is 2 or 3. *Kirw.* This is a very good alum ore, the sulphuric acid and the argil being by proper means separated, and recombined to form that substance.

* Which will be shown in Plate xxviii.

24

TAB. XXIV.

PLUMBUM Galæna.

Sulphure of Lead; Galæna.

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 5. Lead. *Spec.* 7. Sulphate of Lead.
Div. 1. Crystallized.

Syn. Galéne, Sulphure de plomb. *De Born*, *v.* 2. 354.
Bleiglanz. *Emmerl.* *v.* 2. 369.
Sulphuret of lead. *Bab.* 166.
Lead mineralized by sulphur, compact galæna. *Kirw.* *v.* 2. 216.
Plomb sulphuré. *Haüy*, *v.* 3. 436. 7.
Plumbum galæna. *Linn. Syst. ed.* 12. *v.* 3. 133.

This is the commonest lead ore, and is found in Derbyshire and Cumberland; also in Wales, Scotland, and Cornwall. It seldom occurs truly amorphous. The present specimen came from Derbyshire, and is valuable from having the primitive cubic crystals so distinct. They are somewhat brighter than manufactured lead, either outwardly or in the fracture, which rather more resembles manufactured lead fresh cut. Some varieties are brighter than others; which

is said to be owing to their containing more silver. Some varieties have a diverging striated fracture. This ore holds lead in the metallic state. Before the blowpipe on charcoal it decrepitates, but melts easily with a sulphureous smell, part sinking into the charcoal. If alternately heated and cooled, it will at last vanish, and leave its silver, if it contains any. *Berg.* 493.—Spec. grav. 7,587. *Brisson.*

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TAB. XXV.

CUPRUM nativum; *var.* arborescens.

Native Copper; var. *arborescent.*

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 7. Copper. *Spec.* 1. Native Copper.
Div. 1. Crystallized.

Syn. *Kirw. v.* 2. 128. *Hauy, v.* 3. 521.

Arborescent copper differs from the dendritical, (which branches chiefly from its sides, and is mostly compressed,) in branching many ways without compression, and in general being more perfect in crystallization, as it is formed among loose fragments of quartz. The crystals are 12-sided, and sometimes large enough to be easily seen without a lens; at others many are accumulated and attached to each other in different directions, forming the appearance of a rough stem and leaves. They often widen and form macles. The colour and lustre vary from light and bright yellowish-red to bright brown-red. The lower figure I bought in Truro, and understood that it came from a mine in that vicinity. The upper figure is rather between dendritical and arborescent copper, but the definition is of no real conse-

quence. The crystallizations are less perfect, and are made still less so by the green oxide covering the surface, and giving it a more vegetable-like appearance, except that its colour is too gay for any vegetable we know. It comes from Huel Jewel in Cornwall.

Mar. 1 1803 Publifhed by [illegible] owerby London

TAB. XXVI.

CALX Fluor primitiva.

Primitive crystallized Fluate of Lime; or Fluor.*

Class 2. Earth. *Ord.* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 3. Fluate of Lime.
Div. 1. Crystallized.

Syn. Chaux fluatée primitive. *De Lisle, t.* 2. *p.* 15.
Haüy, v. 2. 249. *t.* 31. *f.* 74.
Rashleigh, v. 1. *t.* 24. *f.* 1.

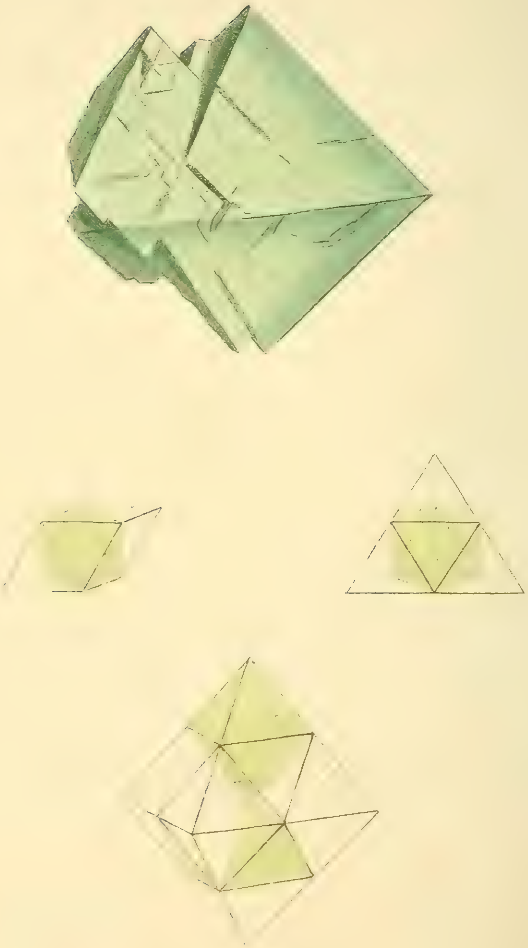
Octaedral fluor is rare, as I have observed at t. xi of this work. The upper figure of the present plate is from a specimen given me by the Right Honourable Charles Greville. It is found at Beer Alston, in Devonshire. I have never seen any of an opaque white but from thence; and, which is an addition to the curiosity of the specimen, the crystals here are alternately opaque white and transparent green, being as it were cased upon one another, 5, 6, or more times. The transparent kind gives the usual vivid glow when laid upon a hot poker, soon crackling and flying away. The white part does neither, and will remain as a defence to the next transparent part, until a stronger heat bursts it. The matrix is commonly hornstone in apparently broad strata, next to a sandy one on the side opposite to the fluor; with considerable hollows, seemingly the impressions

* Perhaps it is merely a carbonate of lime only.

of some large confused crystallization that had been in the next strata. This hornstone, from specimens given me by Lord Heathfield, has sometimes apparently very large green octaëdral fluor on it, covered with quartz crystals, and some varieties of octaëdral pyrites. The irregular fracture of the former gives the matrix an odd appearance, somewhat resembling the ground plan of a fortification, and not unlike what is called fortification agate, found on the Scottish coast. The figure at the top of the plate shows the octaëdron and its cases.

The *lower figure* is octaëdral fluor, from Aberdeenshire. I believe this may be the first time it has been noticed*. They are of a dark purple, but do not detach so freely as the above: they are lighter purple or greenish on the inside, and are heaped confusedly in a stratum of calcareous spar and cawk, if I am not deceived. The figures at the bottom are octaëdrons lying on one of the faces, to show that the fracture which is parallel to the face gives a hexangular form, as expressed at the left-hand figure, and will account for the hexaëdral remains of the crystal in the figure. The more triangular fractures are nearer the primitive faces.

* Jameson does not observe any thing more than that fluor has been found in Aberdeenshire. I think if he had seen any octaëdrons he would have said so.



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TAB. XXVII.

CALX Fluor primitiva.

Primitive crystallized Fluate of Lime.

Class 2. Earth. *Ord.* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 4. Fluate of Lime.

Div. 1. Crystallized.

SYN. . . . . . *Rashleigh*, 1. *tab.* 24. *f.* 2.

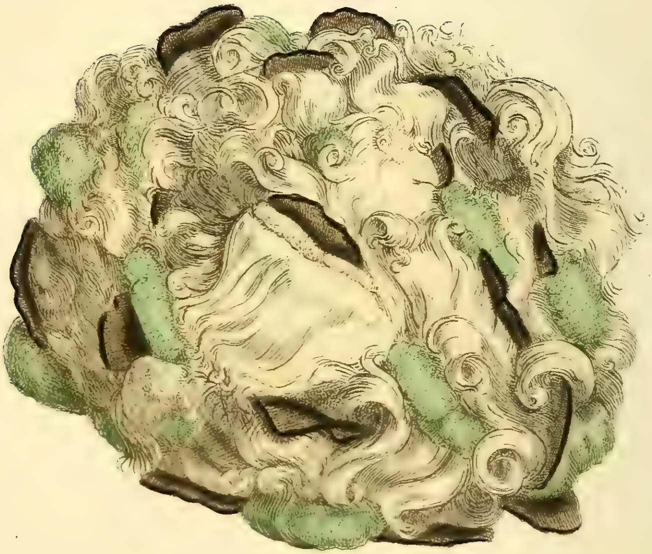
THE *upper figure* here represented seems very nearly allied to the green fluor in the hornstone mentioned at tab. 26. Mr. Rashleigh's, which must by the figure have been a very fine specimen, was elegantly formed among long columns of quartz, and came from the Pell mine, St. Agnes, Cornwall, where I understand my own was found. It is a rarity, as Mr. Rashleigh observes, and I am therefore happy to represent it here. It has no matrix, and appears to have been joined to a larger mass of its own substance, the fragments

of which remain with it, and serve to show that the ruder parts have a tendency to the octaëdral figure. A remarkable circumstance belonging to this and the green part of the fluor, from Beer Alston, is: that on the hot poker it gives a blue green glow nearly like itself, but lighter from its brightness and somewhat more blue, very nearly resembling the chlorophane of Siberia mentioned at tab. xi.

The lower representations are designed to show the nature of the crystallization, which at first appears as if it had a rectangular octaëdron for the primitive and integrant molecule: but on examining the fracture carefully, we find signs of many forms, and can produce fragments truly tetraëdral and rhomboidal; the former of which assists to form the octaëdral; and (vice versa) one octaëdron with four tetraëdrons forms a tetraëdron placed as in the right-hand figure. An octaëdron requires 6 octaëdrons and 8 tetraëdrons to form it, as in the lowest figure. The rhomb, which might be taken for the primitive, is composed of one octaëdron and two tetraëdrons, as in the left-hand figure. An octaëdron is tinted in each to make it more apparent, and the lowest figure has also a tetraëdron coloured. The fracture in fluor is very distinct from that of carbonate of lime, and is parallel to the faces of the octaëdron, each plate having always one hexangular face, sometimes 2, forming altogether a flat octaëdron, like the bottom half of the left-hand figure in plate xxvi. Perhaps fluor fractures into more natural varieties of figures than any other mineral

substance. However, as the octaëdron is always to be found in it, and is included most simply in the tetraëdron, the latter may be called the integrant molecule, and the former the primitive crystal. I do not know that the tetraëdron or rhomb has ever been obtained, except by means of fracture.

28



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TAB. XXVIII.

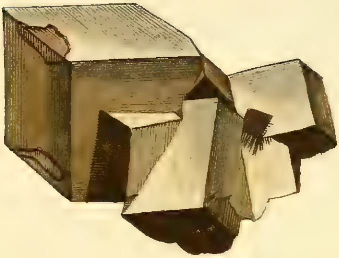
FERRUM sulphuratum.

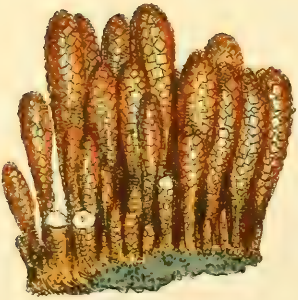
Silky filamentous Sulphate of Iron.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 6. Sulphate of Iron.
Div. 2. Imitative. *Var.* White Silky.

TAB. 23 shows the beginning of this white silky substance, by means of common moist air decomposing the pyrites, which is held in the black clay in such abundance in this specimen, as to separate and divide it so confusedly, that it is only recognizable by the little thin flakes, which still give out small floccose particles if in a damp place. The green crystallized parts in this specimen are also forming into white woolly fibres. Whitby, in Yorkshire, has of old been famous for alum works, as have other parts of the same county. My kind friend the Rev. James Dalton was so good as to send me specimens of alum ore from Mr. Baker's Boulby works. It is a more compact ore than that from Glasgow. Dr. Travis, of Scarboro', gave me some from Skowbrow, among which a baked specimen has some of the silky filaments remaining, as in Tab. 23. Alum has not been discovered native in England. It is said to be found abroad in octaëdral crystals, which is the form of the artificial ones. Of these I have a most superb specimen, sent by the Rev. James Dalton, from Mr. Baker's alum works above mentioned; also some beautiful little crystals formed by agitation in a wine-glass, showing the lesser octaëdrons within the larger, and some curious modifications.

The crystallized specimen from Scotland has a prism.





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TAB. XXIX.

FERRUM sulphureum.

Sulphuret of Iron. Pyrites.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 5. Sulphuret of Iron.
Div. 1. Crystallized.

SYN. Martial pyrites. *Kirw. v.* 2. 76.
Pyrites martiales. Marcassites. *De Lisle, v.* 3. 208.
Schwefel kies. *Emmerl. v.* 2. 289.
Fer sulfuré. *Haüy, v.* 4. 65.

THE *upper figure* is from Cornwall.

This substance is very universal, and not rarely occurs crystallized. It is perhaps as often found in the cubic or primitive form as any thing we know of, especially among the schistose rocks in Wales, Scotland, Cornwall, and Ireland, on what Dr. Babington denominates Calp, vulgarly called Irish Diamonds. This sort was used formerly for making buttons, and was in fashion as jewellery for ladies' ornaments about half a century ago, being cut and polished by the lapidaries for that purpose, often to the destruction of the natural crystal. It is often found among coals, &c.

It forms many varieties of crystallizations. *The upper figure* shows a group of cubes : the larger one appears somewhat laminated in the structure, and is nearly covered as it were with a thin case. They are often quite smooth, but are more frequently found with straight lines or striæ on the faces, alternating with the faces next to each other, but agreeing with the opposite sides or faces. The cubes are often larger than those here figured.

Under the blowpipe the odour of sulphur is very sensible, and a magnetical oxide of iron is to be produced. It scintillates with steel.

The lower figure from Redruth, in Cornwall, with little cubes, piled like clubs, and somewhat varying in colour, perhaps contains a little more copper. Mr. Kirwan says a small portion of copper is always present in pyrites. The upper part being paler than the lower is a sort of indication of its holding most iron. *Spec. Grav.* 4,1006—4,7491.

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TAB. XXX.

FERRUM sulphureum.

Sulphuret of Iron. Pyrites.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 5. Sulphuret of Iron.
Div. 1. Crystallized.

Spec. Char. Sulphur combined with Iron.

These crystals were communicated by the Rev. H. Davies, from Parys Mine, Anglesea, where there is great abundance in some places, heaped together like grains of sand, so small that their lustre is lost in their minuteness, much less can the cubic form be seen without a magnifying glass. The rocks of limestone, and those passing to regular slate, contain them of different sizes. *The upper figure* is from a specimen the gangue of which is between common limestone and slate, and contains no small quantity of the crystals. The gangue is in the more chalky parts stained a little green, perhaps from some oxide of copper. *The lower figure* is a piece of undulated (otherwise common blue) slate, which is a durable sort if free from pyrites, as the common air decomposes the pyrites, decays the iron, and the slate becomes rotten. This will be further explained when we are treating of the best slate of Wales, Westmoreland, Yorkshire, Cornwall, &c.

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TAB. XXXI.

CUPRUM arseniatum.

Arseniate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 4. Copper. *Spec.* 9. Arseniate of Copper.
Div. 1. Crystallized.

SPEC. CHAR. Arsenic acid combined with copper.
SYN. Philos. Trans. for 1801, p. 169.

WE are obliged to Mr. Chenevix and Count Bournon for the best account of the arseniates of copper. They are found at Huel Gorland mine in Cornwall. The simplest variety, according to Count Bournon, is the obtuse octaëdron. He observes that this octaëdron has, in each of its pyramids, two opposite planes more inclined than the other two; which gives a parallelogrammic form to their common base. The two planes which are most inclined meet at the apex of each of the pyramids, in an angle of 130°, and at the common base in one of 50°. The two planes which are less inclined meet at the apex in an angle of 115°, and at the base in one of 65°.

The faces are sometimes smooth, mostly bright, and occasionally show signs of the angles of the tetraëdron, or have striæ parallel to their edges, as Count Bournon observes. He also remarks that the four planes terminate in one and the same point; but more commonly the apex is formed into a ridge, the octaëdron being lengthened parallel to the lesser inclined planes. The base is then a square, or at least approaches nearly to that form. *The first figure* seems to be rare; those with the ridge are more common, particularly such as are further lengthened, passing from the right hand figure in my Plate to the left*. The gangue is an ochraceous quartz with some copper, and often approaches what is called pitch copper: *the right hand figure* has a little green globule of a waxy appearance. Such are sometimes abundantly scattered over the octaëdral crystals, and appear to be carbonate of copper, or malachite.

It is either of a beautiful deepish azure blue with a greenish cast, exactly resembling pure Roman vitriol, or artificial sulphate of copper somewhat opaque, or of a fine green; in which last case it resembles the emerald. Such specimens are most transparent, and vary in being sometimes lighter coloured. These are frequently blue within,

* The Count mentions these as the only two varieties he has observed in the form of the crystals of this species, although he had opportunity of examining a great number of specimens. I am happy to add a new, and I think interesting, variety, especially as it seems, from what has been said above, to be very rare. See tab. 32.

as the fracture readily shows. We shall now consider the present specimens chemically, with the assistance of Mr. Chenevix, who, as well as Count Bournon, remarks the rarity of this substance in any other country; and it appears that Mr. Haüy had only seen the hexaëdral variety of arseniate of copper from Cornwall, in the hands of a friend, when he was about his very ingenious work on crystallography. We therefore may safely conclude that the present and first species of Count Bournon, with all the others, are described in the Philosophical Transactions only, or in works copied from thence. We shall, however, exhibit some varieties not yet described, one of which may be seen in the next plate.

That able chemist Mr. Chenevix, having favoured the public with the analysis, found it to contain

Oxide of copper	49
Arsenic acid	14
Water	35
	98

TAB. XXXII.

CUPRUM arseniatum.

Arseniate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 4. Copper. *Spec.* 9. Arseniate of Copper.

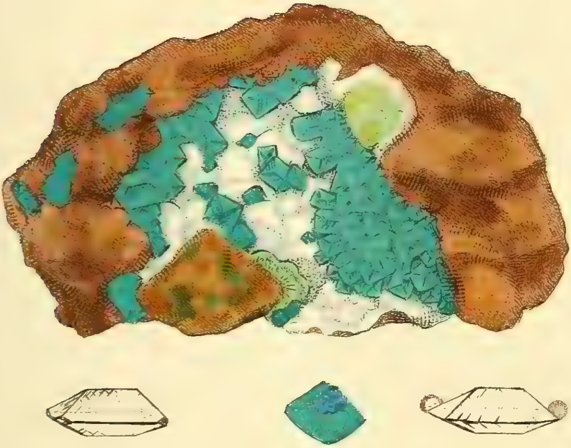
Div. 1. Crystallized.

Var. The solid angles of the mutual base of the two pyramids truncated.

SPEC. CHAR. Arsenic acid combined with copper.
SYN. Phil. Trans. for 1801, p. 169.

THIS being, I suppose, a scarce variety, not having been mentioned by the experienced Count Bournon, I am happy to give a figure of it to the public. Among the clusters of grass-green crystals of arseniate of copper, we mostly find some with the corner of the mutual base of the pyramids more or less rounded. These in the present specimen form regular facets, making it a twelve-sided crystal. The facets pass the common base at right angles, cutting off the four corners: thus the mutual base is an octaëdral plane, at right angles with the four corners of the double pyramids.

They are somewhat uneven, and show evident signs of the want of a few molecules to fill up their interstices. The crystals in general seem to have been disturbed or interrupted, and show markings on their surfaces. Besides this, I have a variety with the sides of the mutual base somewhat rounding, though scarcely perceptible, which is figured in *the left hand outline*. The broken crystal in the middle, to show the blue within, was most conspicuously so, and is figured of its natural size, being larger than usual; the other two are slightly magnified. We have since met with one five-eighths of an inch long.



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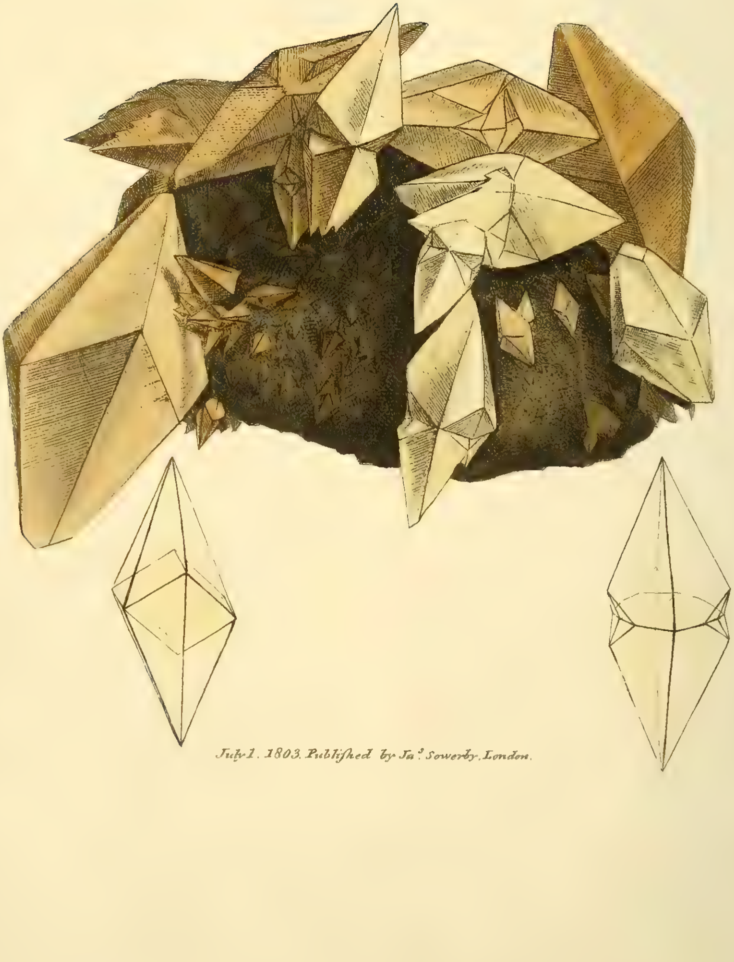

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TAB. XXXIII.

CALX carbonata, *var.* metastatica.

Carbonate of Lime, var. *metastatic.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized. *Var.* Metastatic.

Syn. Dent de cochon. *De Lisle, tab.* 1. *p.* 530.

Chaux carbonatée metastatique. $\overset{2}{\underset{r}{D}}$ *Hauy, v.* 2. *p.* 134.

This form or variety of crystallization of carbonate of lime is perhaps one of the most common, and has obtained the name of Dog's tooth spar in England, and that of Dent de cochon, or Swine's tooth, in France. This crystallization is prevalent of different sizes, colours, &c., in Derbyshire, some affording good examples of the primitive rhomb, being clear, and differing very little from the true Iceland crystal, which is reckoned the most pellucid, and for a figure of which see our *tab.* 2. *The left hand lower figure* shows the usual construction, the edges of the opposite pyramids meeting on the edges of the primitive rhomb, when the obtuse ends are opposite to each apex *, the more acute angles forming three principal ones, and the obtuse three less distinct ones: thus each pyramid has six sides, the acute and obtuse meeting in alternate order at the

* The metastatic is formed by an addition of laminæ, formed of rhomboidal molecules upon the faces of the primitive rhomb, each plate decreasing in width twice its thickness. This will be more fully explained hereafter.

common base. *The right hand figure* represents two pyramids of the same, transversely cut through the middle, showing a plane of 12 sides, and turned on the axis till they meet each other in an opposite direction, exhibiting a remarkable appearance, called by some authors macling. They often seem to be two crystals passing into each other, and are then said to be twins. This is formed on a gangue or lump of manganese, or black wad as the miners term it, which seems to give the crystals a dirty tinge, especially those nearest to it. We do not know that it has any other effect on the crystallization.

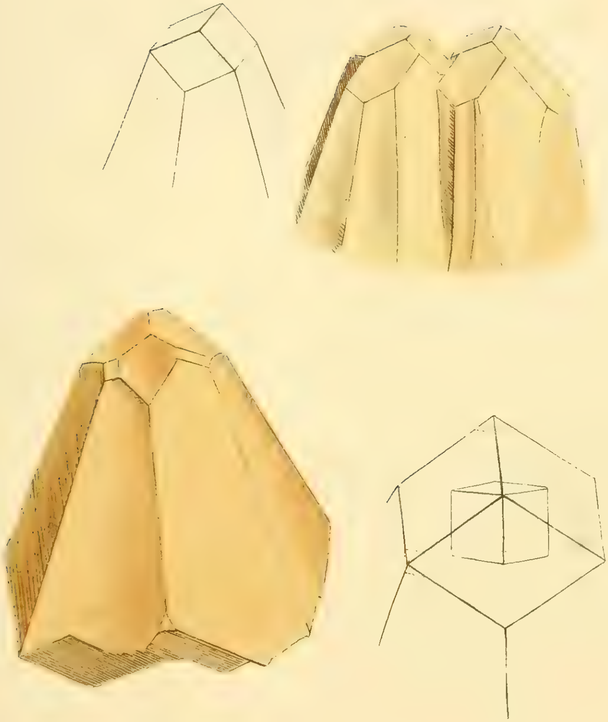
TAB. XXXIV.

CALX carbonata, *var.* metastatica.
Carbonate of Lime, var. *metastatic.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 1. Crystallized.
Var. Crystal metastatic terminating with primitive facets.

Upper Figures. The metastatic crystallization is formed, as before observed, by a particular arrangement of the molecules. These continue to form regularly, according to the supply of those molecules, which, stopping abruptly, terminate in the obtuse point of the primitive crystal, showing three faces. This termination is not very common: the outline on the left hand will help to explain it. The other lateral faces will be spoken of hereafter.

The lower figure shows the equiaxe termination, and *the right hand geometrical figure,* its formation upon the rhomb.



July 1 1803. Published by Jas. Sowerby, London.

Augt 1 1803 Published by Jas Sowerby London

TAB. XXXV.

CALX carbonata, *var.* metastatica.

Carbonate of Lime, var. *metastatic.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of lime.
Div. 1. Crystallized.
Var. Metastatic terminating with equiaxed and other faces.

THIS fine yellowish crystal shows at the apex three polished faces, which are parts of the equiaxed crystals: several others next to them show the approach to the primitive rhomb, and three primitive faces; the rest is part of an unequal-sided or flattish metastatic. The double refraction is seen, when held in certain directions, by the prismatic tints, which are very beautiful, and in some positions catch the rays of light, so as to show them in great abundance in the numerous flaws; which flaws would be some detriment to the specimen, if this appearance did not so well compensate for them. They also serve by their direction to show how the fragments are obtained which exhibit the nuclei. See *tab.* 2.

TAB. XXXVI.

CALX carbonata, *var.* metastatica.

Carbonate of Lime, var. *metastatic.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 1. Carbonate of Lime.
Div. 1. Crystallized. *Var.* Crystal metastatic.

THIS specimen shows a variety of faces depending on certain laws of increase and decrease, and seems more regularly forming the metastatic within, where it abounds with pyrites, than externally. This serves to show that crystallization may continue while one substance has another within it. The pyrites, from their colour, as well as form, should seem to hold copper as well as iron.

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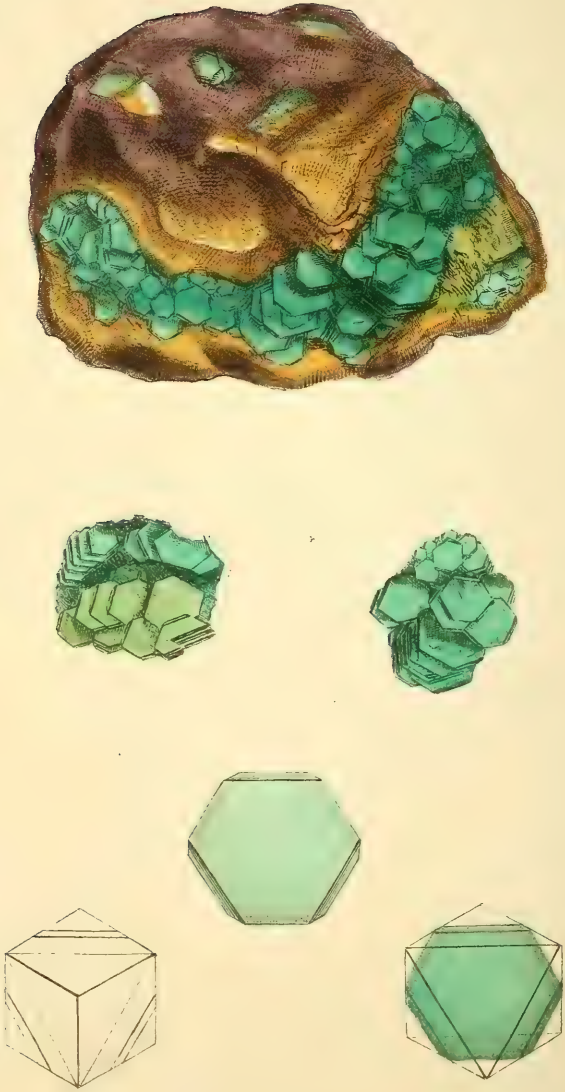

Aug.t 1 1803 Published by Jas Sowerby London

TAB. XXXVII.

CUPRUM arseniatum:
Arseniate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 4. Copper. *Spec.* 9. Arseniate of Copper.

Div. 1. Crystallized.

Var. Crystal an hexaëdral plate with inclined edges.

SYN. Cuivre arseniaté lamelliforme. *Haüy*, *v.* 3. *p.* 578.

Arseniate of copper in hexaëdral laminæ, with inclined sides. *Phil. Trans.* 1801, *p.* 176.

THIS beautiful variety is described by Count Bournon in the Philosophical Transactions for 1801, and we cannot do better than profit by his description. "It is in very thin hexaëdral laminæ, the six sides alternating in an inclined position, with the broad hexaëdral planes on either side at an angle of about 135°, and the third at 115°, on the opposite side." See *fig.* 1. The crystals are more or less piled on each other, and are often to be divided, or split parallel to their surfaces, in the same manner as Mica. They are very brittle, mostly of an emerald green, and as transparent as the best glass, their lustre resembling the thin glass called

frosting; or, as the Count expresses it, the lustre of those coloured metal plates known by the name of foil, and are most splendid when the light falls on the broad planes. The edges are more opaque, partly from the contrary direction of the crystal, and partly from the striæ in the direction of the laminæ. *Fig.* 2. is a general group of crystals. *Fig.* 3. shows a variety in my possession of a yellower tint*.

The lower geometrical figures show, according to Count Bournon's measurement, that if the inclined sides were to be increased by a regular set of decreasing plates placed upon the surface till they formed an equilateral triangle, they would become oblique octaëdrons, (see *right hand figure*;) and if they further continued on these planes till they were lost, they would produce a rhomboidal prism, which, as it seems to agree with the fragments, may be the primitive form. I should have observed that it not only splits into laminæ on the broad planes, but that it also readily does so with the side facets. Its fracture is sometimes irregularly conchoidal and glassy. *Spec. grav.* 2,548. Mr. Chenevix found it to contain oxide of copper 58, arsenic acid 21, water 21.

* These two are somewhat magnified.

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Aug.t . Published by Ja.s Sowerby London

TAB. XXXVIII.

CALX carbonata fœtida.

Botryoidal Limestone with a fœtid smell.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 1. Lime. *Spec.* 2. Carbonate of Lime.
Div. 2. Imitative. *Var.* Botryoidal.

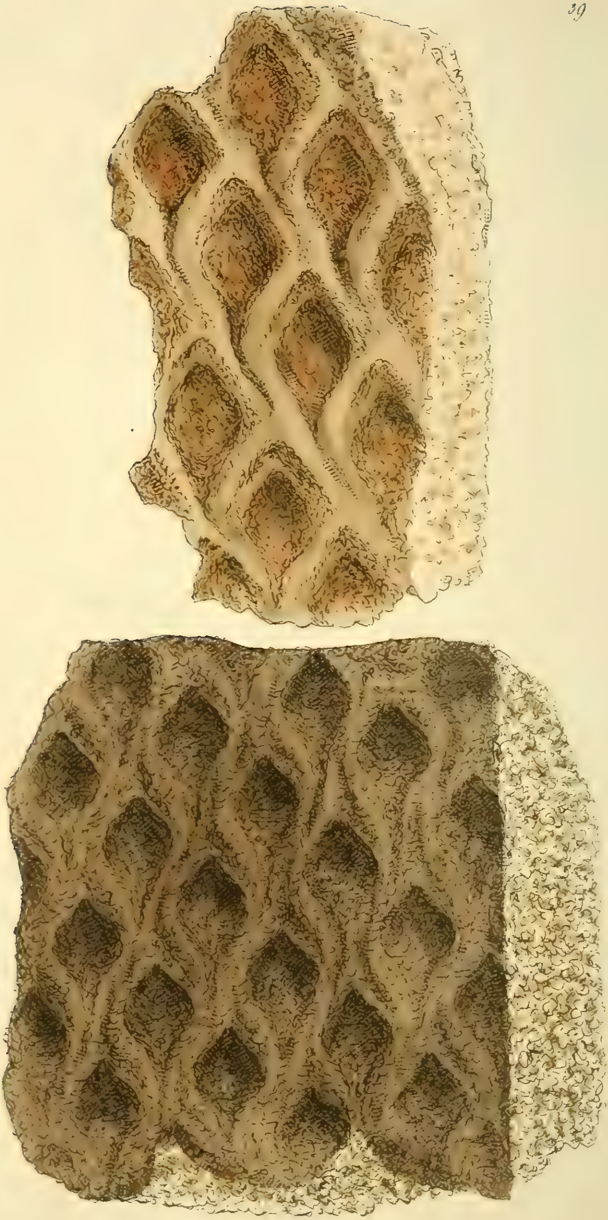
SYN. Swine Stone. *Kirw. v.* 1. 89.
Stinkstein. *Emmerl. v.* 1. *p.* 487.
Chaux carbonatée fétide. *Haüy, v.* 2. *p.* 188.

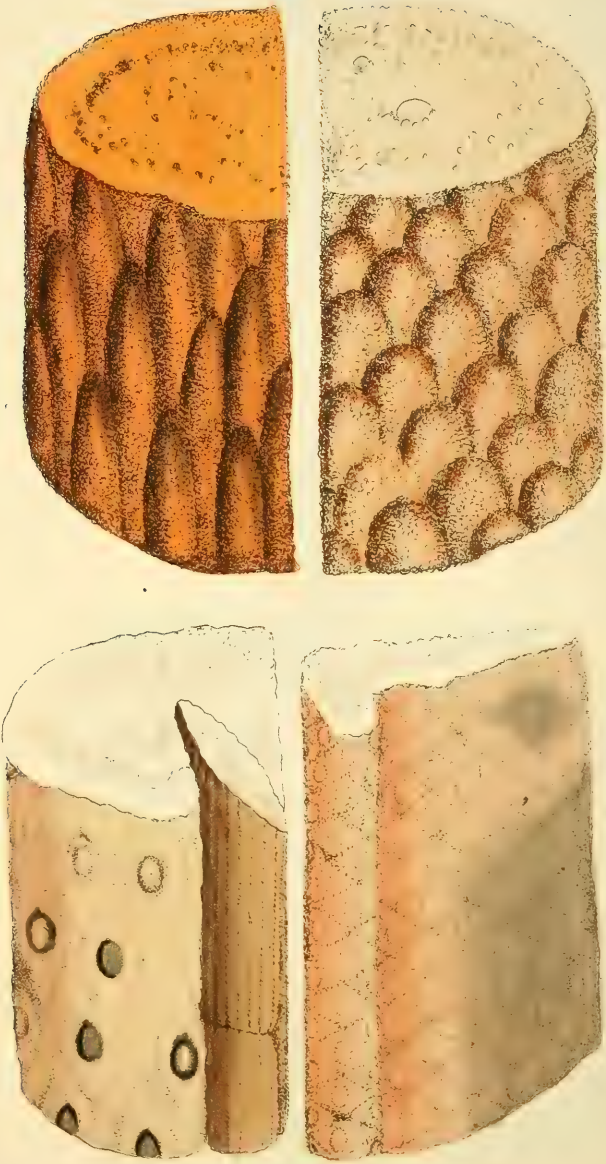
WE have exhibited the present specimen of limestone as a very curious one, on account of its resembling a bunch of grapes. It seems to be formed by water passing through loose marly earth, and consists of smaller or larger globules, according to circumstances; sometimes in bundles resembling Ketton Stone, (see pl. 8, *upper figure,*) at other times much larger (see *the lower figure* in this plate). The globules are occasionally a little hollow, and crystallized within; sometimes nearly clear, and white, when they are destitute of smell; but they are more commonly solid and brown within, have a very fœtid* odour, easily perceived by scraping or pounding. This smell has been ascribed to

* The fœtid variety of *Limestone* is by no means rare.

bitumen, but is of a very different nature. Vauquelin considers it as sulphurated hydrogen. The colour is caused by oxide of iron with more or less clay. The odour goes off from the surface if exposed to the atmosphere; which makes it necessary to scrape it: the heat used in burning it to lime dissipates it entirely.

The lower figure is very interesting, as it shows the stratification while crystallizing, the darker parts making it evident. The top of this specimen is crystallized with the acute ends of the inverse rhomb, (see tab. 4. *upper figure*,) pointing outwards, which is not unusual in this kind of concentric construction of calcareous earths. Lady Wilson first gave me specimens of this stone, from Sunderland in the county of Durham. Mr. Winch, F. L. S. has since favoured me with many varieties of it from the same place. The Rev. John Harriman sent me a specimen from Hartlepool in the same county; and it should seem by his observations that this curious stratum may extend from Hartlepool to Sunderland, all along the coast, and perhaps much further. It is called Building Hill Stone in Sunderland.





Sept. 1. 1803. Published by Jas. Sowerby London

TAB. XXXIX. and XL.

SILEX arenacea.

Siliceous Sandstone.

Class 2. Earths. *Ord.* 3. Aggregated.

Gen. 6. Silex. *Spec.* 2. Grains of Silex more or less agglutinated.

Div. 3. Amorphous.

SPEC. CHAR. Fracture granular.

SYN. Siliceous sandstones. *Kirw. v.* 1. 364.

Cos friabilis. *Linn. Syst. v.* 3. *p.* 63. 9.

— coagmentata. *Linn. Syst. v.* 3. *p.* 63. 10.

Quartz arenacée agglutinée, ou Grés. *Haüy, v.* 4. 464.

SANDSTONES may be said to be composed chiefly of quartz in smaller or larger particles, which, according to Kirwan, should not exceed one third of an inch in diameter. In the representation of such as are not primitive sandstones, it is thought of much utility to put those which have impressions on their surfaces of plants, shells, or other things formerly organized, that while we acquire a common idea of the substance, it may help geological purposes, which will be found extremely essential in mineralogy, as it leads to the æra of formation of different strata, distinguishing by such helps the more recent from the most remote.

TAB. XXXIX.

THE *upper figure* is chiefly composed of irregular whitish grains of quartz, cemented to each other by a sort of agglutination of its own particles, and in some parts with oxide of iron, which gives it the brownish tinge: it has a few specks of mica, and a very little decomposed feltspar. This was sent me by the Rev. Mr. Harriman from Durham.

The lower figure is perhaps the coarsest sort of sandstone, of much the same ingredients, but of a looser texture, with more decomposed feltspar, and was given me by Lady Wilson, who brought it from Walmington in Cumberland. The coarseness of the stone shows plainly that it could not have been formed by human contrivance with the present beautiful ornament, but that it is a natural production, which equals in simplicity and elegance some of the most admired ornaments of antiquity, and may, like them, give an useful hint to modern architects.

The impressions seem to be like the leafy scales of the stem of some plant yet unknown to us. They are most like some foreign Euphorbia or Cactus.

TAB. XL.

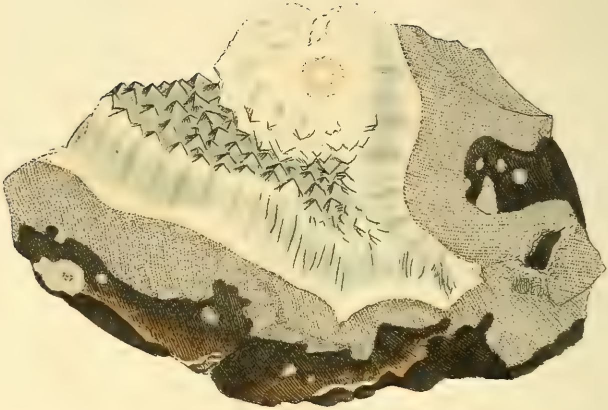
THE *lower figures* in this plate are of the finest texture: the particles in *the right hand figure* are so fine as scarcely to be discerned without a magnifying glass: the fracture, which is a little shattery as well as earthy, in some parts readily shows the sand-like texture. It is more strongly

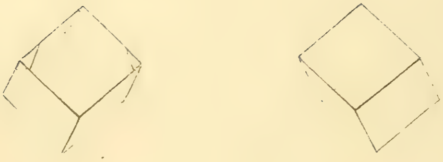
cemented in other parts by means of a very little lime, and more strongly still by a siliceous cement. The original of the impression we do not at present know. The particles in *the left hand figure* are somewhat larger, but are more compactly agglutinated by the siliceous cement, and seem as if more or less fused into each other, somewhat approaching the vitreous appearance. The impression seems to belong to some vegetable, possibly furnished with spines in the order where the little ovate knobs appear, which in a specimen lent me by Sir Joseph Banks were rounder, his whole specimen not being compressed*. *The upper figure* with the long squamæ is what is called by *Kirwan* ferruginous Sandstone, see *v.* 1. *p.* 365. It is coloured with an oxide of iron, which seems to be in that state of oxygenization on the outside, which has the conglutinating power ascribed to it by Mr. Kirwan, and is consequently more compact on the outside than on the inside. Pebble stones held together in this manner are very common in gravelly places about London.

The right hand upper figure is a coarser stone of a similar nature, with some pebbles occasionally here and there about it; also some lumps of a chalky appearance resembling decomposing feltspar, if I may guess by the little remains of the crystal and fracture. Thus it is perhaps next in order

* I have figured the specimen given me by Mr. Martin of Derbyshire, as it had an impression on it resembling a bamboo stalk, although Sir Joseph Banks's was better in other respects.

to the Rubble Stone of *Kirw. v.* 1. 366. Sandstones are found in many parts of England, and are of great use. They are natural filters in the laboratory of nature, and are now become a modern branch of traffic in Derbyshire, London, and other places, for filtering water. They are brought from Newcastle for grindstones, sharpening of scythes, rubbing down copperplates, &c. Some sorts have been used for buildings, as at Windsor Castle, which is chiefly of the whiter kind and fine grained. The grey and black blotches will be explained hereafter. Mr. Martyn above mentioned has given figures of several specimens of these in his Derbyshire Petrifactions.





Sept. 7 1803. Published by Ja.s Sowerby, London

TAB. XLI.

SILEX quartzum primitivum.
Primitive crystallized Quartz.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Silex. *Spec.* 1. Quartz.
Div. 1. Crystallized. *Var.* 1. Primitive.

GEN. CHAR. Rough and harsh to the touch. Soluble in the two fixed alkalis; but in no acid but the fluoric, except (as some think) when in combination with an alkali, much diluted with water; also soluble in 1000 times its weight of water.

SPEC. CHAR. Nearly uncombined. Burns to an opaque white. Spec. grav. 2.64 to 2.67. *Kirw.*

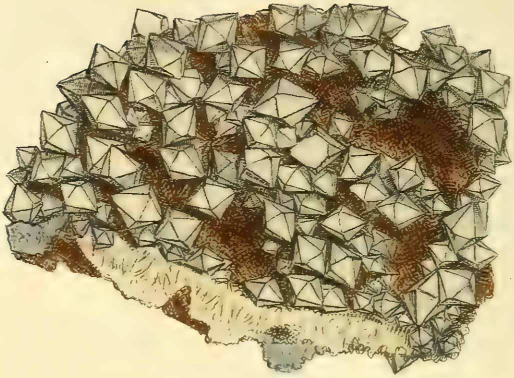
SYN. Quartz. *Kirw.* 1. 242.

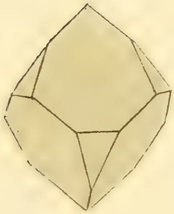
HAÜY says that the primitive crystal of Quartz is the slightly obtuse rhomb, measuring 94° 40′ and 85° 56′. He does not seem to have met with a specimen. Mine, which is formed in a variegated flint, from Lewisham in Kent, showing only one end of the rhomb, agrees with this description, as the primitive: some of them show signs of the other three faces, approaching the double hexaëdral pyramids. See *the left hand figure.*

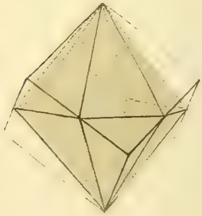
Silica when transparent and crystallized is commonly called Quartz, Rock Crystal, or Mountain Crystal; the purest are generally colourless, and often very brilliant. They were

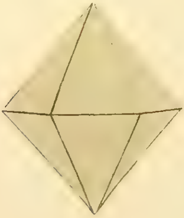
formerly much esteemed, and known by the jewellers under the name of Rock Crystals, and Scotch, Welch, or Cornish Diamonds; nor do jewellers seem to distinguish between Rock Crystal and Quartz, although they chiefly use Rock Crystal.

It is sometimes found yellowish, or of a topaz colour, passing to red, purplish, brown, black, &c. Its lustre is glassy; it is more or less transparent, and is said by most authors to have a double refraction: we, however, could not discover this circumstance. The fracture is coarse, splintery, conchoidal, or undulating, the flaws frequently iridescent. Hardness 10. *Kirw.* brittle, strikes fire with steel, and scratches glass. It is the chief ingredient in making glass, when fused with potash, soda, &c. and seems to be only a purer kind of flint. Diamond has generally been classed as the first species of Silex, but it has at length been discovered to be the purest species of Carbon. Quartz seems very properly distinguished from rock crystal by Mr. Kirwan. The former if exposed to a strong red heat becomes of an opaque white: this specimen is therefore truly quartz, as I have proved by trying a fragment, which being exposed to a strong heat in a common fire became first of an opaque white, and by longer exposure somewhat opaline, or rather like chalcedony; not unlike common flint under similar circumstances. Rock crystals on the contrary, originally dark brown, &c. by the same heat become beautifully transparent, as some lapidaries and jewellers well know.









Sept.r 1 1808. Published by Ja.s Sowerby London

TAB. XLII.

SILEX quartzum. *var.* dodecaëdrum.
Crystallized dodecaëdral Quartz.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Silex. *Spec.* 1. Quartz.

Div. Crystallized. *Var.* Dodecaëdron with triangular faces.

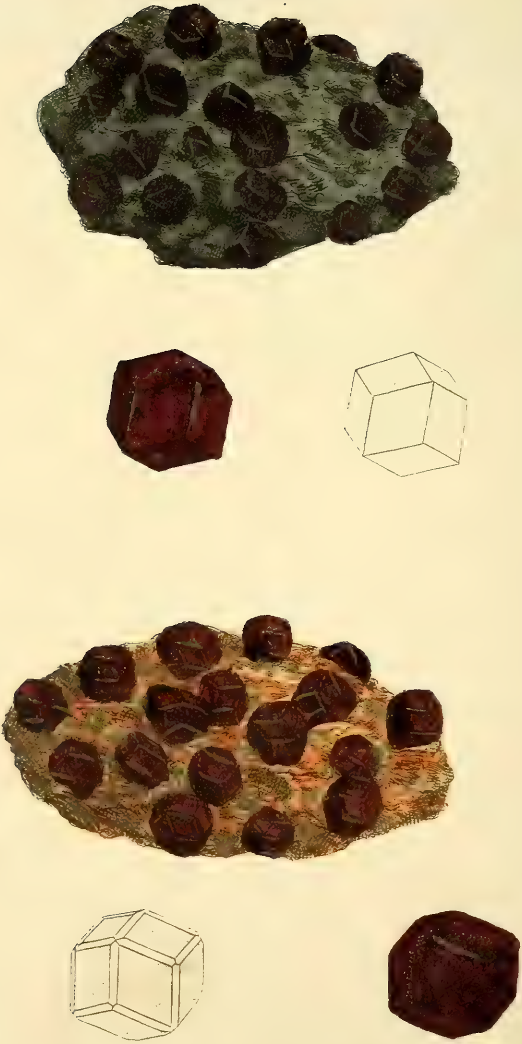
SYN. Quartz. *Bab.* 80.

Quartz-hyalin dodecaëdre. $\begin{matrix} P \\ P \end{matrix}\overset{\frac{1}{2}}{\underset{Z}{e}}$ *Haüy, tab.* 40. *f.* 1.

Cristal de roche dodecaëdre. *De Lisle, t.* 2. *p.* 70.

THE regular dodecaëdral crystal of quartz is somewhat rare. I at present know of no certain habitat for it in Great Britain, excepting at Craig Lackart, about 3 miles from Edinburgh, from whence I have an irregular group given me by Dr. P. Murray, who gathered it himself. It is evidently taken from a rock externally in a state of decomposition, as its matrix is porous and mixed with red oxide of iron. It is sometimes found at Bristol, and also on the Lancashire iron ore or hæmatites, *Bab.* 80. I have such specimens also on an iron ore from Devonshire. The specimen here figured, I believe, is from Cader Idris in North Wales, and seems to have been thrown off from the

main rock by an ochraceous decomposition: on that side towards the rock it is extremely porous, not unaptly resembling French burr, which is used for mill stones. Quartz or silex is not only common in our primitive mountains, but also in our gravel roads. It frequently takes place of animal and vegetable substances, forming petrifactions, or running, like lava or wax, into a mould, occasionally passing into the state of chalcedony, cachalon, &c. Fragments of this specimen became opaque in burning, as did that from Scotland. Crystals of specimens nearly dodecaëdral on Lancashire and Bristol iron ore are properly rock or mountain crystal, as they burn transparent.



Sep.r 1. 1803 Published by Ja.s Sowerby London

TAB. XLIII.

SILEX granatus.

Garnet.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Silex. *Spec.* 13 ? Garnet.
Div. 1. Crystallized. *Var.* 1. dodecaëdral, or primitive.

SPEC. CHAR. Primitive form, the rhomboidal dodecaëdron; scratches quartz.

SYN. Garnet. *Kirw.* 1. 258.
Granat. *Emmerl.* 1. 43, and 3. 246.
Borax granatus. *Linn. Syst. ed.* 13. *v.* 4. *p.* 96.
Grenat. *Haüy*, 2. 540.

GARNETS are of different degrees of hardness. The Oriental and Bohemian ones are of a brighter colour, and are much harder than the British, but all want the aid of the lapidary by thinning them, to show their lustre, and when set by the jewellers are always placed upon a foil. They were much esteemed for hoop-rings, ear-rings, &c. about 40 years ago. The British garnets are commonly much the softest, and not valued by the lapidaries. They are chiefly found inclosed in micaceous and granite rocks, though sometimes otherwise. Besides the other ingredients spoken of in garnets, the British ones frequently hold particles of mica, and are of a less firm texture. We, however, have the satisfaction to find them present most of the different forms of crystal-

lization. We here give a representation of what is reckoned the primitive crystal, (viz.) the rhomboidal dodecaëdron. These are found in great plenty in the Plum-pudding rocks, as they are called, at Huntly in Scotland. We have bought specimens at sales which are said to come from Bohemia, seemingly of the same sort, and in the same gangue as those from Huntly. The Syrian garnet is of a more scarlet hue, though I have some cut ones, said to come from Scotland, nearly of the same colour, but rather less bright.

The lower figures are from rocks near the same place in a lighter-coloured gangue (a granite), with the edges of the dodecaëdron forming 24 narrow hexaëdral facets, in addition to the 12 rhomboidal faces. I have the same sort of garnet, though lighter, in a basaltic stone, and in greenish hornstone from Scotland. Mr. Jameson has found them in micaceous schistus, *v.* 1. 219. *v.* 2. 212. External lustre casual, internal 2. 3. 1. of the brownish and blackish frequently 0. *Kirw.* Fracture of the hard ones somewhat flinty or conchoidal. Mr. Kirwan calls the oriental garnets *carbuncles*, p. 258.

TAB. XLIV.

Shows a variety in a lighter granite gangue with the edges more deeply truncated on the 6 opposite edges, see *the right hand and middle figure*, making an 18-sided crystal. *The left hand figure* shows the truncation equally deep of a 36-sided figure. *The lower figure* forms a prism by 6 sides being elongated. These varieties are more or less distinct in the gangue above.

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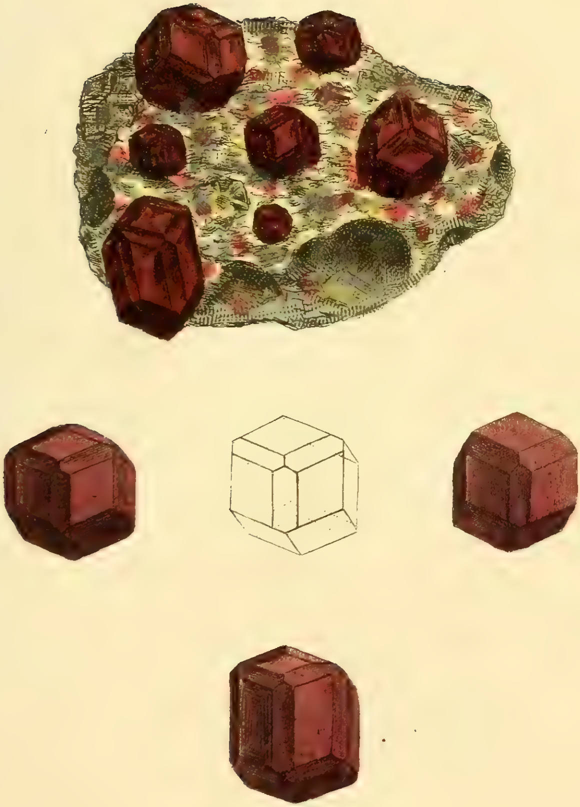


Sept. 1 1803. Published by Jas. Sowerby London

Octr. 1. 1803. Publifhed by Jas. Sowerby. London.

TAB. XLV.

CUPRUM arseniatum, *var.* amianthiformis.

Amianthiform Arseniate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 4. Copper. *Spec.* Arseniate of Copper.

Div. 2. Imitative. *Var.* 2. Amianthiform.

SPEC. CHAR. Copper combined with arsenic acid.

SYN. Amianthiform arseniate of copper. *Bournon, Phil. Trans.* 1801. *p.* 180.

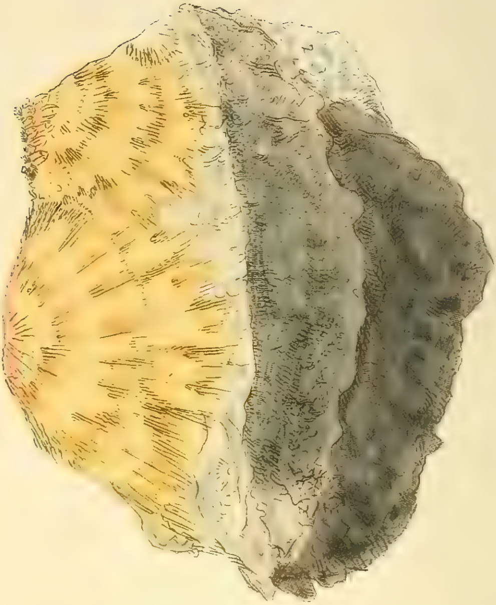
N. 2. 4th species, &c. *Chenevix, Phil. Trans.* 1801, *p.* 199.

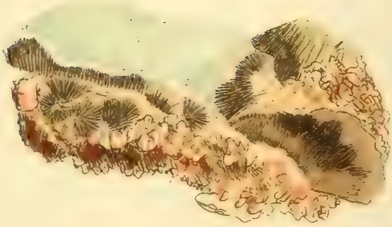
THIS species of copper appears first to have been described by Count Bournon. The present variety is a curious example, and seems so well described by the above author, that we shall transcribe part of his own words. "This variety is composed of fibres as delicate as those of amianthus, of the flexibility of which they frequently possess a certain degree." In the present specimen they resemble the finest filaments of silk. It serves to show a variety in colour not mentioned by Count Bournon, viz. the purple hue, which more or less covers the surfaces or the points of the flexible threads. The other parts are of a lightish straw yellow. Its resemblance to a raceme of currants or a bunch

of grapes made me think that each bundle was composed of fibres formed from its centre (as some of the smaller ones are): but on opening some of them we found an ochraceous gravelly substance in the middle, from which they diverged more or less regularly, often more dense and hard inwardly than outwardly. The more regular ones are commonly more white and satiny than the others, excepting towards the tips, and are more of the texture of rotten wood. The outsides are very tender, and easily bruised. According to the analysis of Mr. Chenevix, this species contains

Oxide of copper	54
Arsenic acid	30
Water	16
	100

Haüy mentions capillary arseniate of copper, *v.* 3. p. 578. and observes "that foreign mineralogists have found different regular forms of arseniate of copper, which from certain circumstances he has not yet been able to determine." *The lower magnified figure* shows some of the fibres or filaments of both sorts here mentioned, some of which are collapsing at their points as if they had been wetted, forming various reticulations and indentations of a purplish hue, apparently retaining that colour from being less exposed to rubbing or any other accident. This was found in Huel Gorland mine in Cornwall, from whence most of the other arseniates of copper come.

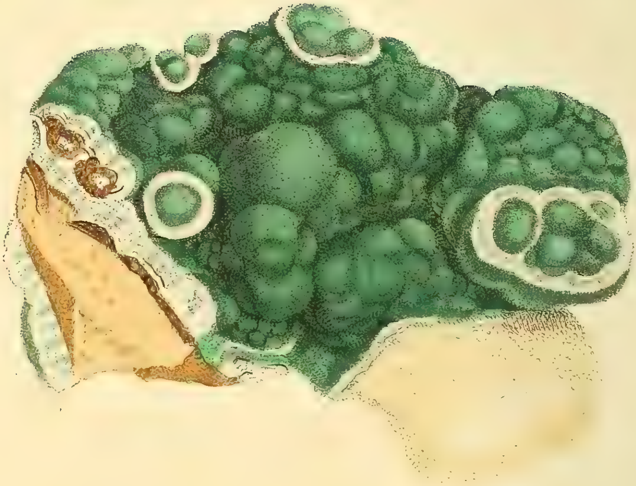




Oct.r 1. 1803. Published by Jas. Sowerby. London.

TAB. XLVI.

THE *upper specimen* is nearly of a straw colour, and diverges in a stellated manner from a common centre, with a good deal of the appearance of that kind of rotten wood called Touchwood. I have seen specimens of different shades of green, which somewhat resemble the Byssus-like carbonate of copper, see *the surface of the lower figure*, where there are also the various colours from straw to dark brown, some of which appear of the colour of darkish brown rotten wood, a little resembling the wood Tin Ore of Cornwall, but may be readily known from it by being so much less heavy than that ore. This appearance occasioned the common denomination of Wood Copper, before Count Bournon's paper above alluded to was published.



1803. Published by Jas. Sowerby, London.

TAB. XLVII.

CUPRUM carbonatum, *var.* byssoides.

Byssus-like Carbonate of Copper.

Class 3. Metals.	*Order* 1. Homogeneous.
Gen. 4. Copper.	*Spec.* 3. Carbonate of Copper.
Div. 2. Imitative.	*Var.* 8. Byssus-like.

SPEC. CHAR. Copper combined with carbonic acid.

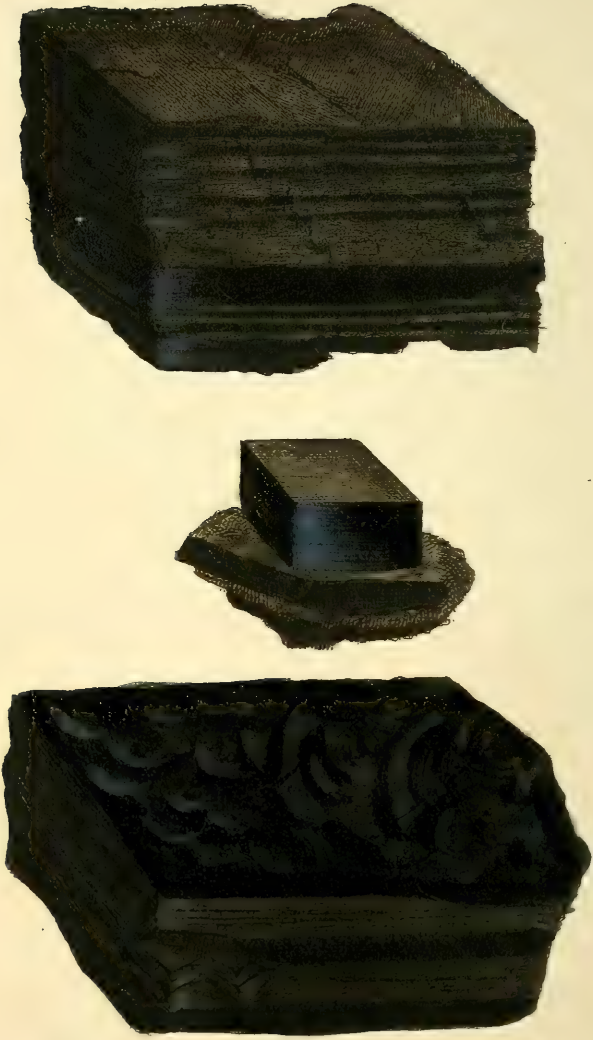
SYN. Green Malachite. *Rashleigh, fasc.* 1. *tab.* 7. *f.* 6.

Cuivre Cabonatée vert soyeuse. *Haüy* 3. 573.

Malachit. *Emmerl. t.* 2. *p.* 253.

MALACHITE Copper ore of this beautiful Byssus-like appearance has been found in great abundance at Llandidno, in Denbighshire. It has rather the appearance of a vegetable than a mineral production, and is most commonly found of a beautiful velvety appearance. The upper surface is extremely tender, and bruises on the slightest touch, assuming a whitish appearance. The sides become more or less white on exposure to the air, and when fresh broken, are of a satiny green, formed of fine thready radii, often closely compacted in stratified order, one coat over another, rightly

compared by Mr. Rashleigh to the coating of an onion. It is found from a light to a dark green; the surface is sometimes tinged with, and passing into a red, or crimson. Its form is generally in protuberating knobs or mammillæ. Malachites, though well known in many parts of England, have been generally esteemed foreign productions: Dr. Babington, however, mentions the harder sort, resembling the foreign, being found at Helstone, and the Land's End in Cornwall, in the South of Wales and Yorkshire. We have it from Wheal Unity, and many parts of Cornwall. The softer sort is not unfrequent among copper ores, with the other which we have from North Wales, as before mentioned; and our friend, Dr. Ridout, was so good as to give us a specimen which he gathered himself at Doddington mine, in Somersetshire. They are said to contain from 66 to 75 per cent. copper, 19·4 carbonic acid, and 5·6 water, and sometimes a little arsenic. Hardness, 5-7. *Kirw.* *Spec. Grav.* 3·5 to 3·994.



Oct.r 1. 1803 Published by Jas Sowerby London

TAB. XLVIII.

CARBO bituminosus.

Pit-Coal.

Class 1. Combustibles. *Order* 2. Mixed.
Gen. 6. Carbon. *Spec.* 1. Bituminous.

Spec. Char. Bituminous oxide of carbon, and oxide of carbon; mixed.

Syn. Mineral Carbon impregnated with bitumen. *Kirw.* 2. 51.

Bitumen Lithanthrax *. *Linn. Syst. Nat. ed.* 13. *t.* 3. *p.* 111.

Steinkhole. *Emmerl.* 1. 60.

Houille. *Haüy* 3. 316. *De Lisle* 2. 590.

Coal is a curious, valuable, and well-known article in Great Britain, supplying us with great store of excellent fuel. There are many varieties in different mines, and even in the same mine. *The upper figure* is taken from a common Newcastle specimen, from whence a great part of

* Linnæus included all coals under this title, describing them as schistose, which does not include all the species,

England, and many parts of the Continent, are supplied. It is evidently composed of two sorts of strata, to external appearance sufficiently distinct. The one apparently the remains of wood in a charred state, like charcoal or oxide of carbon. This has hitherto escaped the notice of most authors: besides the grain and appearance of wood, common in this and most other coals, it will be known by being the only part in coal that soils the fingers. If separated, it burns like charred wood, leaving a similar residuum *; it is also soft and powdery, like burnt wood; breaks in a crumbling manner, and falls into small particles †. The other part is more compact, shining, and brittle, easily scratched with a knife. The least touch of the finger hurts its polish. It has a somewhat splintery conchoidal fracture, and seems chiefly carbon mixed with bitumen. It inflames in a moderate heat, yields much smoke, bubbles, and melts something like pitch, and helps the binding or caking, as it is called, (which is the sign of a good coal, at least for housekeeping) and leaves a cinder which lasts a great while, giving a strong heat. The small remains from a common fire are still valuable on that account for the forge. If burnt long in a violent draught of air, it forms a clinker of no value;

* We have reason to believe that it contains no alkali.

† Mr. Jameson says, "this does not seem a common appearance," when he found "carbonized wood which could not be distinguished from carbonized Fir." v. 2. p. 87. It is probably the smut of Mr. Kirwan.

which shows it to contain some silex, and, perhaps, iron. Coals are not known to crystallize, yet this glossy part in many has a regular disposition towards it in the partings; and these mostly have the same angles, forming an upright prism with rhomboidal bases, the angles of which are about 84° and 96° *.

The middle figure in this plate is a fragment of the Newcastle coal; the completest crystal-like appearance I ever saw. The upper surface is charcoaly, and it rests on a similar substance, with irregular strata beneath.

Newcastle coal loses about 35 per cent. of its weight while flaming.

Linnæus's description seems to belong to the more slaty kind.

The lower figure is from a piece of Scotch coal, which was broke through the bituminous strata, in a transverse direction: and shows the glossy fracture, with a sattiny appearance, as well as the angles of partings. This bituminous stratum is commonly somewhat shaly in this sort of coal: the other part is mostly pure charcoal, and often exhibits the shape of branches compressed, and the same transverse contractions which take place in charring or burning common deal. This coal loses 25 per cent. while flaming, which it readily does, and continues its heat with

* Most mixed coals in the common large masses break through the whole stratum more or less in this form: these breaks or cracks are called backs, cutters, and partings, by the miners.

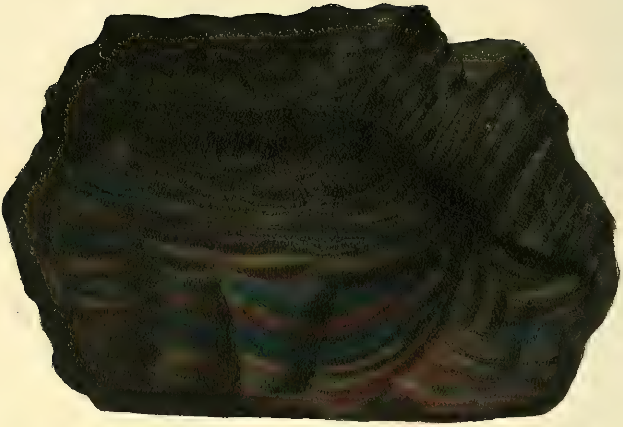
very little bubbling; flaking and falling to pieces in a slaty form, leaving a whitish ash.

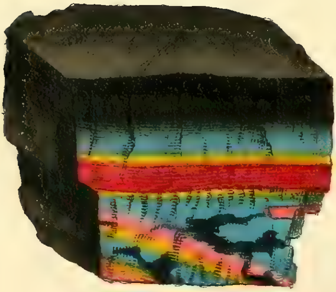
Mr. Kirwan describes Scotch coal from Irwine as "having layers in contrary directions, and being hence often called Ribband Coal. Lustre of the alternate layers 3, 2, (silky and brighter.) Fracture small grained, and coarse grained, curved, foliated. Hardness 4 to 5. *Spec. Grav.* 1·259. Its composition I have not examined."

Mr. Kirwan's description is very good, but, for the most part, will agree with any stratified coal, viz. the Newcastle, Chesterfield, Staffordshire, &c. But this we need not wonder at, from his not having examined the component parts.

I have a coal from Boroughstoneness, given me by Dr. P. Murray, of the kind above described, and some said to be passing into splint, varieties of which are found at Newcastle, Wiggan, and other places. These are often confounded with the Box Coal or Cannel Coal of Kirwan, v. 2. p. 52, the true sort, which is now very scarce. Of these we shall give a fuller account hereafter.

We were favoured by Mr. E. D. Clarke of Jesus College, Cambridge, in February 1804, with specimens of Lynn Coal, presenting pentaëdral prisms, which he has observed in it for more than a year past. Other coals present this figure, and also trihedral prisms. These are produced by a fracture parallel to one of the diagonals of the base of the tetraëdral prism.





Novr 1 1803. Published by Jas Sowerby, London.

TAB. XLIX.

CARBO oxygenizatus.

Oxygenized Carbon.

Class 1. Combustibles. *Ord.* 1. Homogeneous.
Gen. 6. Carbon. *Spec.* 2. Oxygenized Carbon.

GEN. CHAR. Hardest of all known substances.

SPEC. CHAR. Carbon combined with such a proportion of oxygen as to remain in a solid state, mostly opaque black.

SYN. Native Mineral Carbon. *Kirw.* 2. 49 *.

WE find Mr. Kirwan's description of Native Mineral Carbon *, Blende-Khole † of Werner, so well agrees with the Denbigh coal, that the chief part of his expressions may with great propriety be made use of. His specimen, he observes, is the purest known, and came from Florence; it depends much upon the choice of specimens to cull the purest; and in the same mine many varieties may be found.

* When Mr. Kirwan wrote this, common charcoal was thought to be pure carbon; it is since found to be an oxide of carbon, and that Diamond is the only *native* mineral carbon known. Mr. Kirwan's description agrees with oxide of carbon, for which we quote him.

† Mr. Jameson calls this Khole-Blend, and observes that it does not stain the fingers.

There is little doubt of the Denbigh coal being nearly as pure an oxide of carbon as is likely to be found. "Its colour is black; its lustre from 3 to 4, approaching the metallic. Transparency 0. Hardness 4 to 5: brittle: stains the fingers." It could only be the softer part occasionally found in this coal that stains the fingers; as in that from Swansea, resembling charred wood; dusty and with less lustre than above-described *, and what he denominates Culm coal of Wales; another variety which agrees with what Werner calls Glanz-Khole.

Denbigh coal is seldom stratified, and is apt to separate with a reedy structure, or impression, in irregular striæ. The cross fracture is often conchoidal and undulating. This fracture and the prismatic hues for which this coal is famous, have naturally gained it the appellation of Peacock coal; and it is no less remarkable, that a piece with the colours on it, may be heated red hot many times, and, on cooling again, will return to nearly the same appearance, retaining its prismatic hues.

We are happy to say Mr. Jameson promises to give a fuller account of his khole-blend, at some early opportunity, and has also promised, with his usual generosity, to supply us with specimens. All coals commonly so called produce a black powder.

* This, when irregular and loose, as it sometimes is, appears by the description to be the smut of this author. Culm means only smallish coals of inferior value, which do not pay duty.

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TAB. L.

CARBO oxygenizatus.

Oxygenized Carbon.

Some of the Swansea coals resemble the Denbigh coals in their structure, and are nearly the same in quality.

This *upper figure* has the charcoaly and stratified part in various directions. Some parts resemble burnt straw in regular rows: others form conical appearances, converging or diverging from a centre. We also find horizontal and oblique strata. The shining part is in various directions, with a confused and shattered appearance. Some of the striated parts were slightly covered with charcoal in fine dust, easily rubbed off, the striated impression still remaining in immediate contact with the shining part. In other parts were thick layers of charcoal in irregular strata, but somewhat horizontal to the other parts, the whole having a peculiar, yet confused, appearance. It is very brittle, and easily shattered to pieces.

The lower piece is much tougher, and the striæ have not a vestige of charcoal about them, nor will they soil the fingers. This seems altogether more indurated. These two and the Denbigh coal have nearly the same qualities as to their uses. They are difficult to ignite, and burn without flame, remaining a long while, and giving a great heat, without much apparent change; whence they have been denominated Stone Coal. They are used for malting, and for burning lime, and are frequently mixed with such coals

as will more readily inflame, to assist the burning. They are supposed to contain less oxygen with the carbon than other coals, and therefore require the assistance of those which contain more oxygen. It may not be amiss to observe here that diamonds require oxygen to assist their burning, in the proportion of 4 parts to 5 in a strong heat; and in burning they pass into the black state of charcoal, continuing to burn like it, and giving out carbonic acid gas (see description, Tab. I.*) in the same way, the carbon being aërated by the caloric or matter of heat. Although diamond has always been of high value, and well-known from the earliest ages, yet it was left for Mr. Tennant in the year 1796 to prove it to be a pure carbon. See Phil. Trans. 1797. p. 123.

There are other sorts of coals about Swansea, of which we shall speak hereafter. Coals mostly appear to be the combustible remains of vegetation, provided apparently to secure whole forests for the use of after generations. They are mostly formed in the strata of plains, composed of marle, sandstones, and limestones, most of which show the remains of animal and vegetable petrifactions, or impressions. See Sandstones, Tab. XL. The blackened parts in those figures are apparently the remains of bituminous carbon, as it were in the last stage of infiltration.

* It is found native in some caverns, wells, and mines, and is called choke damp of the miners. It is often fatal to them.

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TAB. LI.

BITUMEN Gagas.

Jet.

Class 1. Inflammables. *Ord.* 2. Mixed.
Gen. 2. Bitumen. *Spec.* 1. Bitumen with oxygenized carbon.

SPEC. CHAR. Bitumen combined with about 30 per cent. of oxygenized carbon.

SYN. Jet. *Kirw.* 2. 64.

Jais. *Daubenton* 30. *De Born* 2. 79.

Varieté du Schlakiges erdpech. *Emmerl.* 2. 50.

Jayet. *Haüy* 3. 324.

Bitumen Gagas. *Linn. Syst. Nat. ed.* 13. *t.* 3. *p.* 111.

THE *upper figure* represents a curious piece of Jet, remarkable for the remains and impressions of shells about it. It was sent me from Lowestoft by Dr. Smith, President of the Linnean Society. Jet is well known to have been found on the coast at Lowestoft for many years, where amber and curious pebbles are often found. Some fishermen artists of the neighbourhood employ their leisure at convenient seasons to search for them, and form the two first-mentioned into

small trinkets. We shall consider true Jet to have passed from the remains of some sort of wood, as the ligneous fibre is in some instances seen; in other specimens it is so condensed and compact as not to be discernible. This substance appears also to be saturated, as it were, with bitumen, insomuch that it readily inflames, losing about 14 grains in 20, with much smoke, and a slight bituminous odour. The remaining cinder, if continued to burn, leaves a very trifling residuum. It is well known to be of the most opaque black (witness the common saying, "black as jet*"); but it will bear a fine polish. Its surface excited by friction possesses the resinous electricity, which distinguishes it from cannel coal, a substance it very much resembles. It may be scratched by common calcareous spar, and will itself scratch amber and gypsum. The fracture is conchoidal, occasionally retaining that of wood. Lustre 3 to 4; transparency 0. *Spec. Grav.* 1·104 to 1·744. *Kirw.* It has generally been said to swim on water. Thin pieces, indeed, laid lightly on the water, will float for a short space of time; but at length the water passes over them, and they sink: perhaps some slight trial of this kind might cause the common idea of its swimming. Of many pieces in our possession none will swim. Linnæus called it *Bitumen Gagas*, from the river Gages in Lycia, near which it was found. The presence of

* The streak or powder is always brown.

shells, and the impression of the *Cornu-Ammonis,* indicate its former less indurated state.

The lower piece has some signs of incumbent strata having been on the upper surface, in an obsolete impression, and also some obscure crystals of carbonate of lime underneath. The fracture is in part largely conchoidal. With some difficulty we may observe the woody stratification. It is truly black. I have a piece where the woody texture is very evident, with small cubic pyrites on one side. With heat and water I decomposed a bit of it, so as very satisfactorily to expose its woody structure. It comes very near to the most indurated Bovey coal and surturbrand *, evidently belonging to that division.

* These also produce a brown powder.

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TAB. LII.

AURUM nativum.

Native Gold.

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 2. Gold. *Spec.* 1. Native.
Div. 3. Amorphous.

GEN. CHAR. Malleable, sonorous, reddish yellow, Spec. Grav.

SPEC. CHAR. Uncombined.

SYN. Native gold. *Kirw.* 2. 93. *Phil. Trans.* 1796. *p.* 45.

Aurum nativum. *Waller, t.* 2. *p.* 355.

Gediegen gold. *Emmerl., t.* 2. *p.* 111.

Or natif. *Haüy* 3. 374.

Aurum nativum. *Linn. Syst. ed.* 13.

GOLD is well known to be found in Peru, several parts of the East Indies, and Hungary, often crystallized in octaëdrons and their modifications. It has also been found in Scotland. We have specimens from Cornwall and Ireland. We received a letter from Dublin, dated Oct. 24th, 1795, which relates some curious facts that may be worth men-

tioning here. "It is strongly maintained in the antient Irish records, that in the courts of their kings and residences of their great men, an extraordinary magnificence was once displayed. That they feasted and drank out of vessels of gold, used it for armour, ornaments of dress, &c. In an age when navigation, and therefore commerce, were circumscribed, it is concluded, that the gold must have been found in the country. Those who doubt this judge from the disregard that has been invariably shown by the foreign settlers in this country to its mineral productions. They presume that it could not have escaped their avarice or their skill, if any thing of the kind worth regarding existed here, and they maintain that the gold must have been procured somewhere from abroad. A recent transaction has shown that there is probably much gold in this country not many miles from this city. The people of its neighbourhood have long been acquainted with it, and from time to time sold native gold to the silversmiths, but would not tell where they found it. A late disagreement about the division of their treasure caused a discovery. A stream descending from a mountain * runs along a valley at its foot: in the sand of this stream and the sand of the valley on either side are found lumps of native gold." Pieces have been found weighing 22 oz.; but they are generally much smaller, from 3 ounces to a few grains. It is said some families were in the

* Mount Groghan near Arklow in the county of Wicklow.

constant habit of procuring it*. Endeavours have lately been made to discover the mine, but, as far as we yet know, to no purpose.

The upper specimen was lent me by Sir J. Banks, who bought it of an Irishman who brought some to London to sell to the curious; and this was one of his largest specimens. It is formed of flattish pieces, or lamellated, as if it had been rolled up and beaten about very irregularly, as Sir J. Banks truly remarks, so that it may be called entirely shapeless. It was cut in two at the mint, which helped to discover this foliated appearance; and also, that it contained grains of whitish quartz and an ochraceous gritty clay (*see the cut figure*). A piece of soft lightish schistus, or slate, with a gray appearance on the inside is to be seen in it. The external colour is somewhat redder than where it is broken or cut. Mr. Blackford kindly sent me a piece somewhat paler.

The third figure on the right hand was a piece of a redder cast; that on the *left hand* was the whitest of any I have seen from Ireland. These two were purchased for me by my friend Colonel Velley.

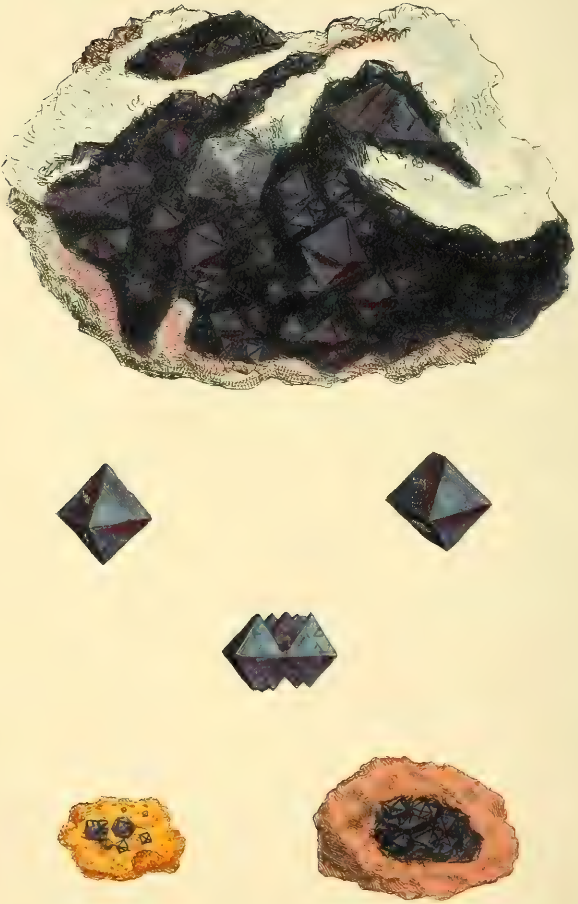
The three lower pieces are different coloured specimens, from Lammon tin stream, near Falmouth, in Cornwall.

* We have been told that lumps of gold of a large size have been till lately used as weights in some of the common shops, and others placed to keep their doors open, in some parts of Ireland, the owners not knowing what they truly were.

Gold is much more scarce in Cornwall than in Ireland. The Irish specimen spoken of in Phil. Trans. was found to contain

Of Fine Gold	$21\frac{6}{8}$
Fine Silver	$1\frac{7}{8}$
Alloy Copper and Iron	$0\frac{3}{8}$
	24

Other specimens differ a little; and thus, if we may judge by the outer aspect, the reddest probably contains most copper and iron, and the whitest most silver. More silver seems to give a greenish tinge to gold: *the little lowest left-hand figure* has that tinge.



TAB. LIII.

CUPRUM oxygenizatum, *var.* octaëdrum.

Crystallized Red Oxide of Copper, Crystal Octaëdral.

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 4. Copper. *Spec.* 3. Oxide of Copper.

SPEC. CHAR. Copper combined with oxygen.

SYN. Red calciform copper ore. *Kirw.* 2. 135″.
Native oxide of copper. *Bab.* 174.
Roth-kupfererz. *Emmerl.* 2. 213.
Cuivre oxydé rouge primitif. *Haüy* 3.557.

SOME of the crystallized red oxides of copper deserve from their lustre the appellation of Ruby Coppers more than others, which will be shown hereafter. The present fine specimen has more of the steel-like lustre, as most of the octaëdrons have: however, the beautiful red sparkles internally with much brilliancy. It is not difficult to scrape it with a knife, and the least scratch produces a rich red powder of the colour of the gum called Dragon's Blood *.

* Known in the Pharmacopœia by the name of *Sanguis Draconis*, and extracted from *Calamus Rotang* of Linnæus.

The specimens look red most by candle-light. They are found in Wheal Unity, near Redruth, in Cornwall, and in other parts of that county, as well as in different parts of Europe. Foreign specimens, as far as I have seen described, seem not to be superior in the size or perfection of their crystals to the Cornish ones. The matrix of our upper figure is shattery quartz, supporting native copper, from which the oxide seems to proceed. It is worthy of remark, that this kind of oxygenizement should form so regular a crystallization, for it appears to be only a decomposition of the native copper from which it commences.

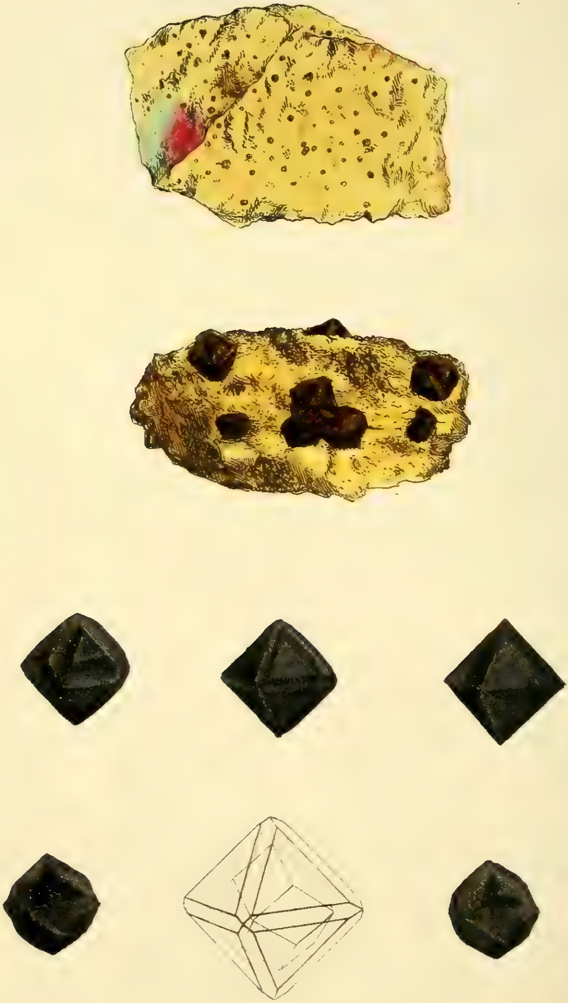
The lower figures are in different matrices,—one in a red powdery oxide of copper and iron; the other in an ochraceous matrix, chiefly oxide of iron.

It agrees with the following parts of Mr. Kirwan's description: "It is often cochineal red, or intermediate between blueish-gray and carmine red. Found massive, investing, disseminating:" he does not mention its being found crystallized. "Fracture even, approaching to the minute conchoidal, sometimes earthy. Hardness 4 to 5, brittle. Effervesces with nitrous acid, to which it gives a green tinge, and a blue to caustic volalkali."

Thus much till Mr. Chenevix had shown that there was only one proper oxide of copper of a black colour, and that the present species is rather a suboxide of copper, containing

Copper	88·5
Oxygen	11·5

whereas the black oxide contains 20 per cent. of oxygen.



TAB. LIV.

FERRUM suboxygenizatum.

Magnetic Iron Ore.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Iron. *Spec.* 2. Magnetic.
Div. 1. Crystallized.

SPEC. CHAR. Iron in combination with but a small portion of oxygen *.

SYN. Iron in a calcined state mineralized by pure air. *Kirw.* 2. 157.

Magnetischer Eisenstein. *Emmerl.* 2. 278.

Fer oxydulé. *Haüy* 4. *p.* 10.

Ferrum tesselare. *Linn. ed.* 12. *t.* 3. *p.* 136.

I WAS much pleased when I discovered this curious crystallization in a pyritaceous copper ore sent me, among other favours, from the neighbourhood of Tavistock, by my kind friend Mr. John Taylor junior.

The crystals are dispersed through the ore in tolerable abundance; but being small, do not readily distinguish themselves to the unassisted eye: with a lens, however, they are very satisfactorily seen, with the variety of modifications here figured, and sometimes, by breaking them, we find them curiously casing each other 2 or 3 times. They are most readily attracted by the magnet, and will support a part of the gangue of pyrites that may chance to be attached to them, of 8 or 10 times their own bulk. The gangue is said to be rich in copper, and is commonly of a bright and pale golden colour, sometimes with a greenish hue, and often iridescent.

* 15 to 24 per cent. *Kirw.* vol. 2. 158.

I do not know that this crystallized variety of magnetic iron ore has been observed in Great Britain before. Dr. Badham gave me a fine octaëdron of the Swedish sort, from Fahlun (where such specimens are not rare), which is above half an inch in diameter: but this is not more strongly attracted by the magnet. It is coated with mica, and, within, is of a more or less deep-brown red, as are ours, sometimes approaching steel-gray and black, partly shining, and metallic. Fracture uneven, somewhat earthy. The crystals are arranged in convenient order, to see the additions that assist in modifying the different crystallizations, (viz.)

The upper figure on the right hand exhibits the regular octaëdron, the faces of which, by the addition of the laminæ of superposition, or superior coating, form long six-sided facets, which are those of the dodecaëdron with eight triangular faces parallel to those of the octaëdron, see the *middle figure.* These are the nearest approach we have seen to the octaëdron in our specimens; with more laminæ, it keeps the same form which is shown, but with smaller triangular facets in the *left hand figure* and the *right-hand lower figure.* In *the lower figure on the left hand* the laminæ have advanced so far as to form the complete rhomboidal dodecaëdron. *The geometrical outline* shows this manner of casing over each other; but we must beg our readers to substitute the octaëdron in lieu of the dodecaëdron in the centre, as we find is the case upon further examination since the engraving was finished.

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TAB. LV.

SILEX quartzum, *var.* arenaceum.

Sandstone.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartz.
Div. 3. Amorphous. *Var.* 2. Graniform.

Syn. Ferruginous Sandstones. *Kirw. v.* 1. *p.* 365.
Cos colorata. *Linn. Syst. Nat. ed.* 13. *v.* 3. *p.* 64.

Sandstones are not uncommonly impressed with the casts of shells, &c. They are little else than granulæ of flint, with iron more or less oxidated : the oxidation is most conspicuous in the crevices where the shell has been mixed with a little lime, or other things, giving them different tints. The shapes of many sorts of shells are found in these stones, mostly Arcas and Anomias. The acuminated sides of the Arca on the stone at the *right hand* seem accidentally formed, from the peculiar manner of its immersion in the mass. They are often found detached as figured, and serve to undeceive us. These Arcæ, as they surely are by the length of the hinge, apparently contain many denticula-

tions, or teeth *, the distinguishing character of the genus. The singular rising in the middle of the upper shell, of about 5 pleats wide; and the corresponding cavity in the under one, is a curious character, common, with some variations, to both these and the Anomia, with which they have generally been confounded. The little Anomiæ at the bottom are darker, and probably contain more iron. Their structure is certainly remarkable, especially as we, in the present age, have no recent shells in this part of the world at all corresponding with them. We think these the more interesting on that account, as they help to indicate, that at certain periods there were some animals very different from those now existing.

These were sent me from the Tees by the Rev. Mr. Harriman, and also by Mr. Winch, in large fasciculi. They are found in other parts, but I do not know how near the present surface of the earth.

They are but little crumbly in their fracture, rather condensed, and approaching to the conchoidal, like flint: they are often very tough, but too heavy for building, and not of any known utility at present: they, perhaps, might be liable to decay, as the ochraceous substance is somewhat scattered through them. They sometimes contain more or less clay.

* See Arca, t. xv. p. 35.

[illegible]

TAB. LVI.

FERRUM oxygenizatum, *var.* radiatum.

Radiated Oxide of Iron, or *Hæmatites.*

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 3. Oxide of Iron.
Div. 2. Imitative.

SYN. Red Hæmatite. *Kirw. v.* 2. 168.
Rother Glass-kopt. *Emmerl. v.* 2. 313.
Hematite. *Haüy, v.* 4. 105. *De Born, v.* 2. 287, XI, F. c. b. 1.

THE Hæmatite Iron ores are found near Silverstein in Lancashire in great variety and abundance. The upper specimen is somewhat singular, from the separating and divaricating radii. *The lower figure* shows more of the usual structure of these ores, which often form large roundish or irregular nodules, sometimes kidney-shaped, botroidal, &c. the masses radiating from one or more centres, 6 inches or more in length, and casing or coating one over another. They are mostly of a brick red colour, easily staining the fingers, particularly the powdery parts:—the harder parts also stain the fingers much, and by a little rubbing give a black tinge

with a bright lustre not unlike black lead. Those parts which have lost the red appearance, and approach the metallic or iron lustre, do not so readily stain the fingers. On being ground these give a deep red colour; whence this ore has been called Blood Stone. Sometimes the harder black sort with this property is cut into burnishers for gilders.

These ores are said to contain from 40 to 80 per cent. of iron. The harder kind is sometimes a little magnetic, if reduced to powder, particularly if heated on charcoal; which deprives it of a certain quantity of oxygen. "Fracture coarse or fine fibrous, parallel or diverging, earthy." Hardness, from such as may be easily scraped with a knife to such as will strike fire with steel. Spec. Grav. from 4 to 5, Kirwan.

"This ore contains, besides some manganese, a large proportion of argill, which renders the iron it affords *red-short*, that is, brittle when red hot." Kirwan.

Jan.y 1 1804. Published by Jas. Sowerby, London.

TAB. LVII.

SILEX Analcimus, *var.* compactus.

Compact Analcime.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 8. Analcime.
Div. 3. Amorphous.

SYN. Analcime. *Haüy*, *v.* 3. 180.

THIS curious substance is not uncommon in Great Britain, wherever basalt and trap are found. We have some specimens from different parts of Scotland, which contain it in nodules. The present specimen came from the Isle of Isla. It is somewhat stalactitical, and extremely various in its shapes, sometimes forming roundish drops from the size of a pin's head to that of a large pea, and often of a knotty elongated figure like a potatoe. It seems to be a transition from quartz, and decomposes into filaments forming zeolite. This specimen exhibits it beginning to form filaments. The bottom of the larger mass, which somewhat resembles the humerus, or thigh bone, of an animal, appears once to have been in a thick fluid state, and might give some idea of the forming of the flints in chalky rocks, (see page 15.)

which however is not quite satisfactory to me. More of this will be mentioned in another place. They may be found somewhat various in their colours. The most common are nearly as here represented; transparent white or glassy, and often pearly or greyish within; the outside being coated with a light brown crust often nearly opaque, which gives an idea of fresh cast wax. The fracture is irregular, glassy or flinty. Analcime may be found in most of these appearances so hard as to resist a knife, like quartz; but in the state of compact zeolite, or passing into fibres, it may be scratched with a knife or any steel instrument, though it resists iron and brass.

We are not sure that this is the true hyalite of Kirwan; who says it does not fuse per se at 150°. Ours fuses per se at the heat which turns carnelian white, which Kirwan observes was 160°.

1 1804. Publish'd by J. Sowerby, London

TAB. LVIII.

SILEX Analcimus, *var.* fibrosus.

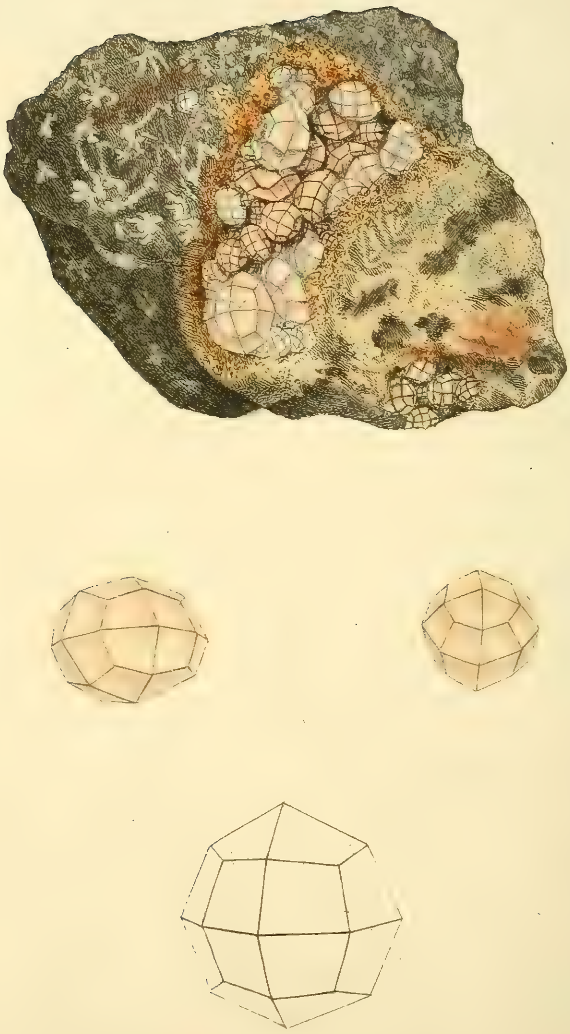
Fibrous Analcime in Trap.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 8. Analcime.

SYN. Zeolite. *Kirw. v.* 1. 278.
Analcime radié. *Haüy*, *v.* 3. 182.

ZEOLITE, formerly so called, is often found in trap, as if passing from opaque hyalite of Kirwan (see our Tab. 57.), at length leaving the spaces where it was first formed empty, and giving the stone the appearance of a scoria or basaltic lava. This is a red variety of basaltic trap, which has hyalite of a pebble-like appearance in one part. In some cavities it has partly fibrous zeolite; in others the zeolite appears in fine filaments, sometimes of a silky lustre, filling the holes like cotton or with loose threads, which are often scattered more or less in irregular bundles, somewhat radiating. The hollows which contain these are mostly lined with small crystals. These at first sight look like quartz, such as often sparkle in common flints, but if examined with a glass their structure determines what they are. See Tab. 59. and magnified figure at the middle and bottom of this plate.

We use the old term of zeolite, as being most familiar; at present it is synonymous with analcime.



TAB. LIX.

SILEX Analcimus.

Analcime.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 16. Analcime.

SPEC. CHAR. Primitive form, the cube. Spec. Grav. about 2. Electricity difficult to excite by friction. Vitreous. Fusible per se into a transparent glass.

SYN. Vesuvian or white Garnet. *Kirw. v.* 1. 285.
Wurfel zeolith. *Emmerl. v.* 1. 205.
La zeolithe cubique. *Broch. v.* 1. 304.
Analcime. *Haüy*, *v.* 3. 180.

VESUVIAN or white Garnet* is the only substance mentioned in Kirwan that at all agrees with this species†: but in this, as in many other substances described by that great author, he does not observe whether he had ever seen any thing like it found in Great Britain.

* The substance commonly called *Vesuvian* should not be confounded with this, as it is a very different substance which is called *Idocrase* by Haüy, 2. 574. and is mostly of a dark colour, but is probably included under Mr. Kirwan's 18-, 36-, and 56-sided crystals of *Vesuvian Garnet.*

† Including only his 24-sided crystals.

The specimen here figured came from Kirkleston, 8 miles west of Edinburgh, and seems always to present the same crystallization more or less compressed. The crystals vary in transparency from translucid to nearly opaque white, and are often of a pale red, sometimes of a dull salmon colour. I was favoured with some of these from Calton Hill near Edinburgh by Mr. Neale. The fracture is often very confused, and somewhat like quartz after being dropt red hot into water. I however had the good luck to find one, among many specimens sent me by Mr. J. Murray of Edinburgh, with the proper cubic fracture, which leaves me no room to doubt that the crystals here figured belong to the cubic zeolite of Brochant. The Dumbarton crystals that I have seen are also the same species. Mr. J. Murray, who sent them to me, is of the same opinion. The rock however in which they are found differs, as well as the manner of their immersion. Those figured are in grunstein* of Werner, (see Kirwan 1. 353.) and situated in hollow cracks or fissures. Those of Tab. 58. are lying in hollows or moulds, and are apparently the residuum of the substance which previously filled the space. Mr. Kirwan speaks of Vesuvian garnets from the size of a pin's head to that of an inch. We have some which differ in appearance only by a dirtier hue, the gangue often partly sticking about them, which is of a muddy brown : the mould or holes they were in are some smooth and some rough. This is the amphigene of Haüy, and might be confounded with the analcime : but the latter

* Hornblende and felspar.

can be fused by the blowpipe; and if of the transparent kind, it at first becomes opaque: if the heat be continued it becomes transparent, and at length fuses. The opaque first become transparent, and then fuse. Mr. Kirwan says the Vesuvian garnets fuse per se: but our Vesuvian garnets appear to agree with what Haüy says of his amphigene, (viz.) that it is infusible, although the analcime may be fused: both sorts are said to be found at Vesuvius. The hyalite, zeolite, and analcime of these 3 plates seem nearly allied*, and by some are thought to be varieties of each other. We hope, however, analysis will soon clear up the point. Haüy takes his name from the weak degree of electricity this mineral receives by being rubbed; and we have found it just capable of holding a hair for a short time.

* As they are all fusible per se by the blowpipe, and agree somewhat in this particular with the Scotch phosphorescent zeolite, of which the analysis is given by Mr. Kennedy in the Phil. Magazine; it is desirable for that gentleman to examine the difference, and favour the world with the result.

TAB. LX.

FERRUM oxygenizatum, *var.* radiatum.

Radiated Oxide of Iron, or *Hæmatite.*

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 3. Oxide.
Div. 2. Imitative. *Var.* radiated.

SYN. Brown Hæmatites. *Kirw. v.* 2. 163.
Brauner Glass-kopf. *Emmerl. v.* 2. 323.
Fer oxidé Hæmatite. *Haüy, v.* 4. 105.

THIS variety of hæmatitic iron ore, with which I was favoured by Mr. Murray, comes from near Edinburgh, and has not long been discovered. It has much the appearance of crude iron, with nearly the same shining fracture in the direction of the radii, but blacker and duller in the opposite direction. These radii sometimes terminate like brushes in the matrix, which is a brown clay. It is not magnetic.

Some of the variety figured at Tab. 56. is occasionally found about it. The ends are some of them terminated beyond the matrix, like the ends of a bunch of wires, or obscurely crystallized with the ends approaching those of Tab. 62. and 63. Mr. Kirwan says, "seldom steel grey.

"External lustre 2, 3. Internal lustre 2, 1.

"Spec. Grav. from 3·789 to 3·951. Streak reddish or yellowish brown." In ours the powder is the same colour as the streak. "It is not magnetic until calcined. Before the blowpipe, it blackens, and gives to borax a yellow tinge with some effervescence."

We do not know that this has been analysed.

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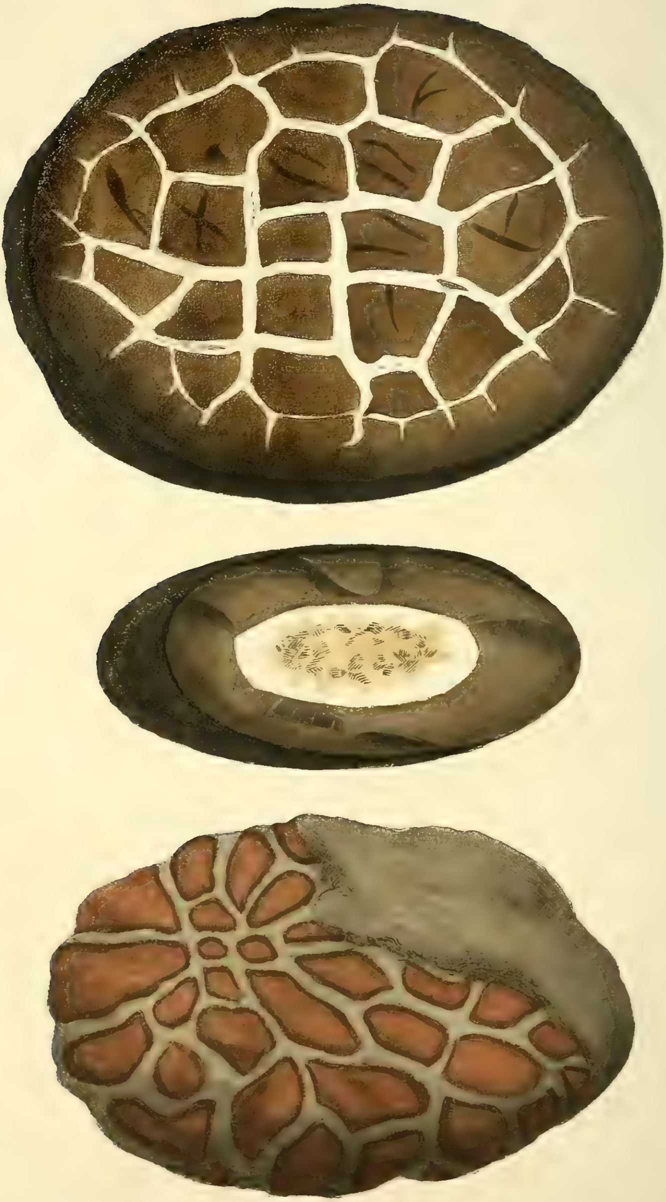


TAB. LXI.

FERRUM argillaceum.

Argillaceous Iron Ore.

Class 3. Metals. *Order* 2. Mixed.
Gen. 7. Iron. *Spec.* 1. Argillaceous.
Div.

SYN. Common argillaceous Iron-stone. *Kirw. v.* 173.
Lowland Iron Ore. *Bab.* 199.

AMONG other iron ores a great deal of the sort above figured is used. It is chiefly iron mixed with clay, producing 30 to 50 per cent. as we have heard. This variety is admired for its being divided into polygonal columns by calcareous spar. It is found in round or compressed lumps, called by the miners cats' heads or cats' scalps.

It appears that the iron clay in lumps has cracked internally, and that calcareous earth has crystallized in the fissures*. *The upper figure* shows it as it commonly appears when cut. Bitumen is sometimes contained in the cracks, as are various other substances. *In the middle figure* the calcareous spar is mixed with blend, and is more concen-

* These divisions depend on the vicissitudes of wet and dry, hot and cold, and approach to the nature of the Giant's causeway in Ireland, &c.

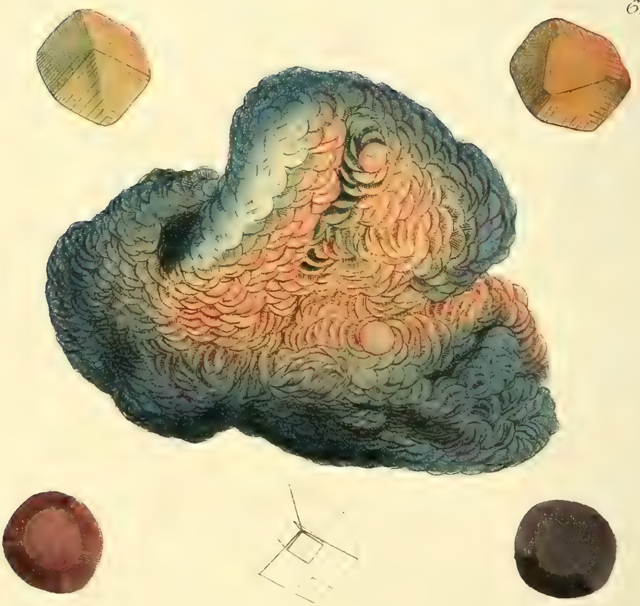
trated. It was brought to me from Scotland by Dr. Peter Murray.

The lower figure is similar to the uppermost, except being externally in a state of decomposition, probably from exposure to the atmosphere among the tumblers (as they call the stones in common) in the river Tees. We received it from the Rev. Mr. Harriman. Its redness is caused by the oxygenization of its iron. The outside is so far decayed as to expose the divisions of carbonate of lime. These are called septariums, of which there are various sorts; and besides those of iron stones there are to be found some of marle of various sizes, at Bristol, the Isle of Sheppy, Richmond, and many other places.

The sort in the upper figure is often so much admired after being split that it is frequently cut and polished. The fracture is conchoidal, earthy, and the component parts more or less regular in their mixture, holding

Iron,
Clay,
Lime,
Silex, and
Manganese.

62



TAB. LXII.

CALX carbonata ferrifera, *var.* lenticularis

Spathose Iron Ore; Lenticular crystallized Carbonate of Lime.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 2. Lime. *Spec.* 4. Carbonate of Lime.

SYN. Calcareous or Sparry Iron Ore. *Kirw. v.* 2. 190.
Spathose Iron Ore. *Bab.* 201.
Spathiger eisenstein. *Emmerl. v.* 2. 329.
Chaux carbonatée ferrifère lenticulaire. *Haüy, v.* 2. 178.
Mine de fer spathique. *De Lisle, v.* 2. 281.

THIS singular group of spathose iron ore, as it is often called when gathered with the iron ores of Devonshire, may with as much propriety be called a calcareous spar. The crystallization is found to be as it were intermediate between the latter and the former. *The top left hand figure* shows the primitive rhomb somewhat flattened, formed by aggregations of the primitive rhombs of calcareous spar. See Tab. 2, 3, and 13. *The right hand upper figure* differs only in having the apex truncated, and the edges having rounded facets. *The lower left hand figure* shows the same with the rounded facets having become the principal faces of the crystal. It is altogether rather flatter and rounder. *The lower figure on the right hand* is still flatter and rounder, and approaches more to the irony appearance.

The first is a pearl spar of the usual light appearance, the second more coloured with iron, the next more so still, and the last most of all. They may perhaps contain a little manganese. The outline shows the position of the primitive rhomb in the *upper figures*, in the others it is situated as in the æquiaxe. Some specimens of these were sent me by Lord Heathfield from Devonshire. I have had others of nearly the same nature from the Isle of Man by favour of the Duke of Athol and Lord Henry Murray. They seem to indicate iron in their neighbourhood, and may be useful in smelting it; but are themselves very deceitful, their appearance giving a stronger indication of iron than belongs to them; which will in general be detected most readily by breaking, as the fresh fragment discovers them to be a mere limestone with a slight pearly tinge, which on being exposed to the common air and water will assume the same deceitful tinge as the former exposed parts. These have generally been reckoned among the lenticular ores, and may have deceived many by their external appearance.

TAB. LXIII.

THIS is nearly the same, with very flat lenticular crystals standing edgeways, of a dull rusty appearance, the matrix nearly of a similar substance, with some lustre. The whole shows the gradation of tints, and the fresh fractures are lightest, as is common in these varieties. *The left hand figure* has some signs of the triangular and other faces partly remaining; in *the right hand figure* they are entirely lost: *the middle figure* exhibits a transverse section, fresh broken, with signs of the confused rhomboidal fracture.

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TAB. LXIV.

FERRUM oxygenizatum.

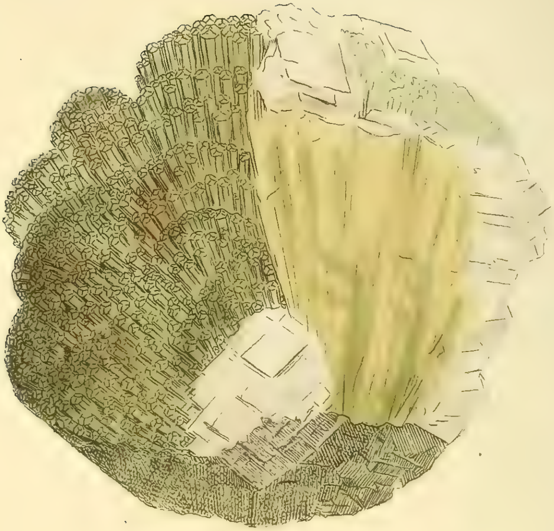
Foliated Oxide of Iron.

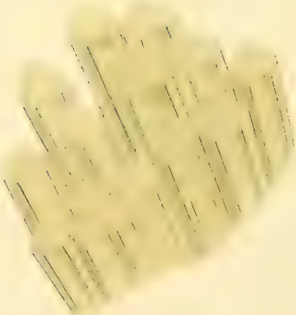
Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 3. Oxide of Iron.

SYN. Plumbaginous or Micaceous Iron Ore. *Kirw. v.* 2. 184.
Eisen-Glimmer. *Emmerl. v.* 2. 306.
Fer oligiste écailleux. *Haüy, v.* 4. 45.

THIS curious variety of iron ore is found in Wales, Scotland, Cornwall and other places. It has the appearance of iron with somewhat of the gloss and the blackish grey tint of black lead, occasionally with the blue, purple, and sometimes the other iridescent colours. It is more or less flat, irregular or undulating, in very thin broad laminæ, one over another. They have two sets of parallel lines crossing each other obliquely, and forming the plain of a rhomboid. It is found in rocks of quartz, and the *upper figure* has some yellowish mica about it. *The right and left hand middle figures* show the parallel lines crossing some fragments, and the undulating structure. It is not attracted by the magnet. It is very brittle, and easily breaks into small irregular fragments.

The sparkling middle figure is known by the common name of glimmer, or scaly iron ore, and often accompanies the above, as well as the black and red hæmatites. It is blackish or red occasionally. The little bright faces of the scales reflect the light with great brilliancy, particularly by candle light, as the figures will show with the utmost nicety, as the very substance was of necessity used for its own representative. *The biggest figure* is among broken quartz or rock, covering the surface or filling little hollows in a scattered manner. *The lower figures* are aggregated bundles, which are often found much larger: they have sometimes a tendency to crystallize in small rhombs, but I have not yet seen them large or distinct enough to be measured. The angles appear to be the same as in the foliated part above, to which the lower evidently belongs. It is found in Devonshire, whence we received it by favour of Colonel Montague and the Rev. A. Neck. The same was also sent from Scotland by Mr. Winch. *The upper one* was received from Wales, by favour of the Rev. Mr. Williams.





TAB. LXV.

STRONTIA carbonata.

Carbonate of Strontia.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 5. Strontia. *Spec.* 1. Carbonate.

Div. 1. Crystallized.

GEN. CHAR. Soluble in 200 parts of water at a temperature of 60°. Separates from a saturated solution in nitric acid, in the form of rhomboidal crystals. Promotes the fusibility of most other earths. Most of its salts tinge flame red.

SPEC. CHAR. Combined with carbonic acid.

SYN. Strontian earth combined with fixed air. *Kirwan, v.* 1. 332.

Strontian carbonaté. *Haüy, v.* 2. 327.

THIS curious mineral was found some time since at Strontian in Scotland, in a lead mine which is now given up, as it would not answer the purpose of the proprietors; but seems not to have been suspected to contain a new earth until Dr. Craufurd sent it to Mr. Kirwan in 1790. It was afterwards examined by Dr. Hope and others. We do not know that it has been found any where else. Its crystals are confusedly grouped, more or less diverging from a centre. They sometimes show the appearance of a six-sided prism, as Haüy has observed.

The specimen figured was sent me by my friend Mr. Sims of Norwich. It has 6-sided prisms, terminated at one end with three faces, resembling those of carbonate of lime, with the obtuse æquiaxe termination. We have a specimen with six-sided bars quite relieved crossing an hollow: three faces of the prism are generally broader than the other three, showing faint longitudinal striæ and fractures parallel to them; but most readily to the three broader faces with transverse striæ, which continue to the apex of the pyramid, and occasionally form an equilateral triangle. The pyramid may be divided in a direction contrary to its faces; therefore the nucleus is a dodecaëdron with rhomboidal faces.

They vary in colour from a brightish watery green to a palish brown. It differs from carbonate of barytes (with which it was once confounded), by its weight, as well as by dissolving quickly, and with great effervescence, in nitric acid, without leaving a precipitate: and it is curious that a bit of paper or a wick of a candle, dipped in this solution, after being dried, causes the flame to burn beautifully red; or the substance itself in fusion by the blow-pipe will do the same thing. Spec. Grav. from 3.4—3.675. Hardness 5, according to *Kirwan*. Scratches carbonate of lime, and is scratched by fluate of lime.

Analysis by Pelletier:

Strontia - -	62.
Carbonic acid -	30.
Water - -	8.
	100.

It is accompanied by carbonate of lime, sulphuret of barytes, sulphuret of lead, and harmotome of Haüy, or staurolite of Kirwan.

66.

TAB. LXVI.

FERRUM oxygenizatum, *var.* crystallizatum.

Crystallized Oxide of Iron.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 7. Iron. *Spec.* 3. Oxide of Iron.
Div. 1. Crystallized.

GEN. CHAR. Colour grey. Harder than most other metals. Attractible by the magnet. Spec. Grav. 7.2—7.84. *Kirw.* Capable of combustion by collision. *Bab.* Soluble in all the acids; precipitable from its solutions, the precipitate being of a blue colour, by prussiate of potash.

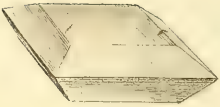
SPEC. CHAR. In combination with above 24 per cent. of oxygen.

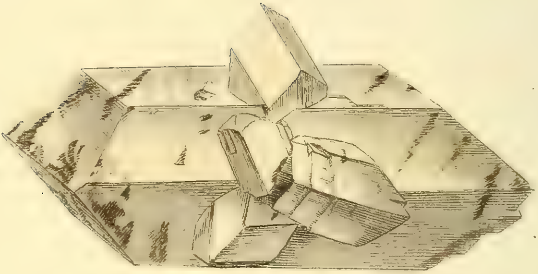
SYN. Specular iron ore. *Kirw. v.* 2. 162.
Fer oligiste. *Haüy, v.* 4. 38.

THE peculiar form of this minute crystallization I could not pass over, especially as it may be a very proper one in arranging the varieties of the species to which it belongs. The sort of iron ores from Lancashire, on which these crystals are sometimes found, is not uncommon: there are also

minute quartz crystals, frequently very transparent, attached to this ore; which on the dark ground deceive us with the idea of crystallized iron ore: however, with the help of a lens, it may often be discovered whether we are right or not, by the form of the crystals. The latter, although a seeming modification of carbonate of lime, appear to be slightly magnetic. It is a very curious circumstance that this should so generally resemble, in the form of its crystal, the carbonates of lime, this being like a flattened æquiaxe with various modifications. Romé de Lisle's, *p.* 4. *f.* 62. is the nearest resembling it, wanting only the 6 alternating narrow faces. The fracture is intermediate between glassy and splintery, and when fresh broken it shows an iron or steel-like lustre. The outsides of the crystals are of a darker iron or steel-grey with much gloss or polish; the edges of some resemble blued steel, and sometimes reflect other colours. They stand edgeways on the matrix; which makes this hue more conspicuous, and adds much to the beauty of the specimen, especially when magnified.

We presume this is the same as the beautiful iron ore from Elba, now first noticed in England.





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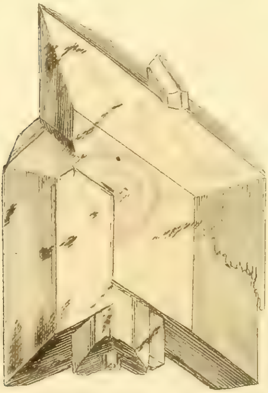

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March 1. 1804. Published by Jas. Sowerby. London.

TAB. LXVII.

CALX sulphata*.

Crystallized Sulphate of Lime, or *Gypsum.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 3. Lime. *Spec.* 6. Sulphate of Lime.

SPEC. CHAR. Lime combined with sulphuric acid.

SYN. Broad foliated Gypsum. *Kirw. v.* 1. 123.

Gips et Fraveneis. *Emmerl. v.* 1. 527. 540.

Chaux sulfaté trapezienne. $\overset{2}{C}\ \overset{1}{E}\ P$. *Haüy, v.* 2. 270.

Natrum selenites. *Linn. Syst. Nat. v.* 3. 91.

SHOTOVER Hill, Oxfordshire, seems to afford the clearest and cleanest specimens of crystallized gypsum in the greatest variety: yet we find some varieties are rather local, as shall be shown hereafter. They are mostly found in a clayey gangue. *The upper figure* is what Haüy calls *trapezienne.* Although this would by extending the lateral faces, which might be easily done by piling plates on the summit, each smaller than the last, form an octaëdron; yet of a great many varieties which we have seen we have not observed this modification. *The middle figure* shows a very frequent variety from the same place, heightening towards an octaëdron; but seldom extending much further than this figure. They often have their angles a little irregular, so as not to meet: *see the left hand corner near figures* 1 *and* 2, also having other crystals sticking in them in different directions. If

* The specific name at tab. 21. should be read *Calx sulphata,* and not *sulphurata.*

the laminæ are opened in the manner of a flaw or crack, when not too wide, they admit the prismatic rays: *see the upper face of middle figure and middle face of lower figure.* They are said to admit of double refraction by most mineralogical writers.

Fig. 1. is a darkish spot of clay or soil naturally in the subject, and *fig.* 2. is the same seen a little duller through the other face at the same time: but this is common to all transparent substances. It is somewhat curious that the clayey stripes or spots have a particular direction diagonally to the acute angles. Spec. Grav. 2.2642—2.3117. *Kirw. and Haüy.* They are laminated, the laminæ somewhat flexible; easily separated.

Hardness,—yields easily to the finger nail.

The bottom figure shows three crystals mixed together, and forming what is commonly called a macle.

TAB. LXVIII.

Is a variety from Bedfordshire, sent me by favour of the Rev. T. O. Marsh, showing a tendency of the laminæ to separate and bend, which they will generally do in the longitudinal direction. Thus, a plate of gypsum will be found to break less readily in this direction, always bending before it breaks, and then generally ruggedly. In the other directions, it is either glassy or foliaceous. When these crystallizations spread like *the lower figures,* they are commonly called Lions' paws. Crystallized selenites are the moonstones of Gesner and Agricola. See *Plott's Oxfordshire, p.* 81.

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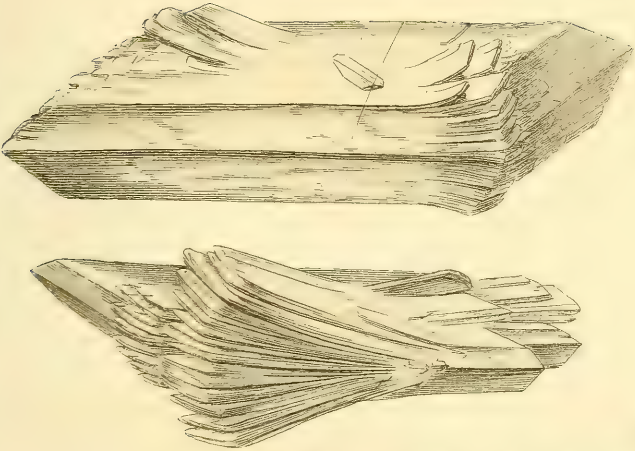

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TAB. LXIX.

ARGILLA durissima.

Scotch Corundum.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 2. Argil. *Spec.* 8. Corundum.

Gen. Char. Unctuous to the touch. Easily diffusible in water. Adheres to the tongue. Spec. Grav. 2. *Kirw.* Combines difficultly with acids, forming with most of them deliquescent salts, soluble in borax. *Bab.*

Spec. Char. Nearly pure argil, hardest of all minerals except the diamond. Divisible parallel to a rhomb, the angles of which are 86° 26′. 93° 34′.

This curious substance was sent me among other things from a dealer at Aberdeen, under the name of Red Schorle from Achen-door. I figure it here, because it is a substance which appears to be new to British writers. Upon inquiry I found it was very little known, nor was it to be found in any mineralogical collection in London, nor scarcely in Scotland. I therefore was glad to present a few of my friends with it. Even Mr. Jameson had not previously obtained it. From him I hope for a good account of it. It occurs in long columns or bars from an eighth to three quarters of an inch thick, mostly confused, often diverging

and with transverse flaws, having the matrix intervening abruptly. Its fractures are longitudinal and splintery. The columns are four-sided, with faces replacing the edges in the centre of the angles: on one, two, or more sides, the ends approach towards a pyramid (in such as I have seen) with four rhomboidal faces. Among a tolerable quantity, I found very few with crystallized terminations, as figured: the faces however are very distinct.

We find this fossil has been taken for a rubellite, and Kirwan's description in a great measure accords with that idea. See *Kirw. v.* 1. 288. but in many respects it has been confounded with the titanite of Kirwan. See his description. May the radiating variety be the substance of which Macquart says the garnets are formed? He describes it as consisting of straight fibres diverging from a common centre. See *Kirw. v.* 1. 261. Its common appearance resembles garnet much, but it is not fusible by the blowpipe, whereas garnet is fusible into a black enamel.

Kirwan mentions red schorl, *p.* 271, and says rubellites are also so called. Another substance resembling this, according to the short description of Mr. Kirwan, was found by Morveau in Poitou, *v.* 1. 336, which he presumed to be adamantine spar. Again, as Haüy observes, another mentioned by M. Morveau, found in Le Forez, resembles it greatly, and which is of great hardness. See *Kirw.* 337.

Hardness of ours nearly the same as that of spinelle. We found that the harder spinelles would scratch it; but the softer ones are scratched by it. This seems undoubtedly the "Spath adamantin d'un rouge violet" of Bournon, which he described in the year 1789 from specimens found in Le Forez, (*Journal de Physique* 453.) and now considers as a variety of corundum. Other authors have had a similar idea. We here subjoin a part of his description: see

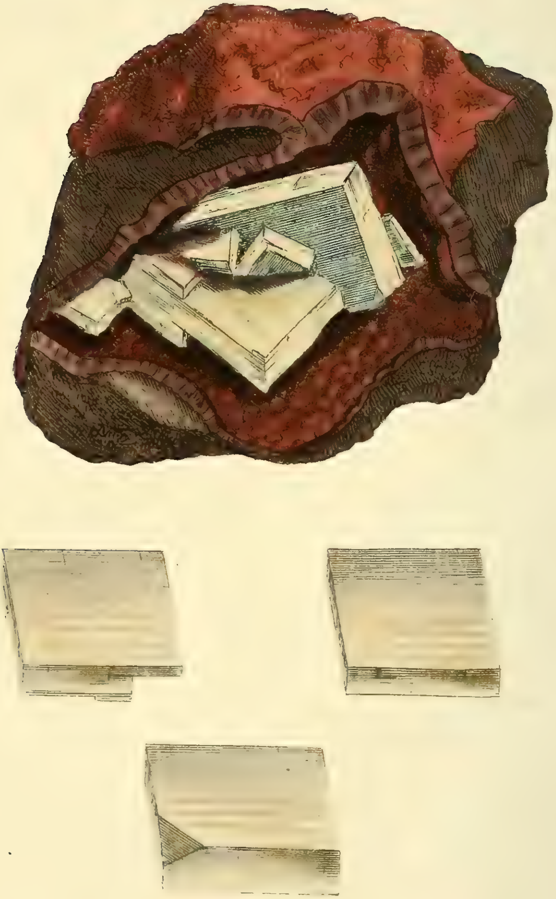
Phil. Trans. for 1802, 323. where quoting *Haüy, v.* 4. 562. who observes "that it scratches quartz; that its specific gravity is 3·165, and that it is infusible by means of the blowpipe;" Bournon observes, "that it is red with a purplish tinge*; that the appearance of the substance was entirely different from that of felspar; and that where it came in contact with the felspar it seemed to mix itself with it in such an insensible manner, that after having sawed and polished a piece composed partly of felspar and partly of the substance here spoken of, it was impossible by the eye to distinguish exactly where the felspar began, or where the other substance terminated." Ours is readily distinguished from felspar, which it invests occasionally so that it is formed round it like a tube, *see the middle figure at the bottom:* it is also often running among it in the directions of the fragments, often passing abruptly across it. The nearest approach to mixing insensibly is by fibres, which in ours are however sufficiently distinct. The Count continues to observe, "that the pieces he had collected varied considerably in their degree of hardness, although all of them were harder than felspar usually is, for many of these pieces would scarcely scratch felspar; whereas others could scarcely be scratched by the greatest number of gems, or precious stones. The characters of the last-mentioned or hardest pieces appeared to be very similar to those of the imperfect corundum from China, a crystal of which Romé de Lisle had sent him a short time before. The above observations, joined to the remarkable manner in which this substance was mixed with the felspar, made him adopt the erroneous opinion mentioned by the abbé Haüy in his obser-

* Some of ours are also of a greenish tinge, especially when between the ey and the light.

vations upon corundum; namely, that this substance might be nothing more than a dense variety of felspar. He soon however entirely gave up this idea, after he had it in his power to examine more particularly the nature of corundum."

Upon comparing the mechanical divisions of the corundum of Ceylon with the Scotch one, we find that it is not only parallel to the six faces of the rhomb, as described both by Bournon and Haüy, but also parallel to eight other faces, all which are mentioned in Haüy's description of his felspath apyre, two of which are mentioned by him in his Telesie, and the other six not mentioned any where as existing in the corundum of Ceylon, but which we find in some of our specimens. These faces are not so neat, or so easily obtained, as those parallel to the rhomb. The gangue is chiefly composed of a coarse granite intermixed with indurated asbestos.

Mr. Jameson mentions the corundum of Tirie; which however must be very different from this, and he quotes Mr. Greville's memoirs in Trans. of Royal Society for 1798, page 40, who observes that it scratches glass readily, but not rock crystal. Jameson says, "I believe there are specimens of this corundum in the Museum of the University, and of these I shall probably communicate an account in the close of this volume:" but as he does not seem to say any thing more about it, we hope we shall have it settled in his work now coming out. We presume that this is no more thought of as a corundum, as C. Bournon in Phil. Trans. 1802 makes no mention of it as such: therefore ours is the only thing known at present as a corundum from Scotland.



TAB. LXX.

BARYTES sulphata, *var.* primitiva.

Sulphate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 2. Sulphate.

SPEC. CHAR. Combined with sulphuric acid.

SYN. Baroselenite. *Kirw. v.* 1. 136.
Schwer-spath. *Emmerl. v.* 1. 550.
Baryte sulphatée. *Haüy, v.* 2. 295.
Natrum cristatum. *Linn. Syst. Nat. v.* 3. 90.

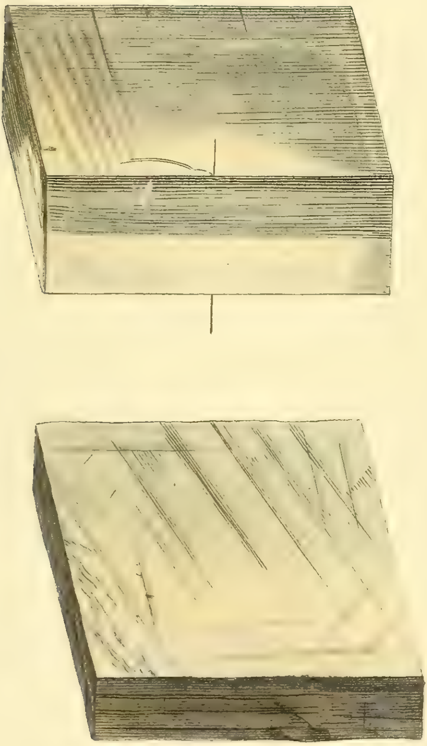
PONDEROUS Spar, as this was commonly called in England, agrees with the Greek term *βαρυτης, heavy*. The uncommon weight of this substance in comparison to that of other stones has very naturally obtained it this appellation. It is frequent in or near lead or iron mines in many parts of the world, as well as in many places in Great Britain, as Derbyshire, Cumberland, &c. —— When transparent, it is generally crystallized and separa-

ble into laminæ, much resembling carbonate of lime, and gives a double refraction through the rectangular faces only, but somewhat weaker than that of carbonate of lime. This is a curious circumstance, and perhaps has not yet been noticed. It may lead to the true nature of double refraction. Haüy had recourse to the ingenious method of forming artificial faces to discover this property.

Our specimen is on an iron ore from Lancashire, and is as near the primitive as is generally seen in Great Britain.

TAB. LXXI.

THE upper fragment is in the form of the nucleus, or an upright parallelopiped; and as the faces are the same with the primitive, it is placed with the upright faces on a line, to show the refraction is not double in that direction: and it is to be observed that it requires a large depth of crystal to see the refraction through the other faces without the assistance of a lens. The flaws show the prismatic tints, like other laminated crystals; this shows the depth of the flaw, and it is so sufficiently elastic that we can, by pres-



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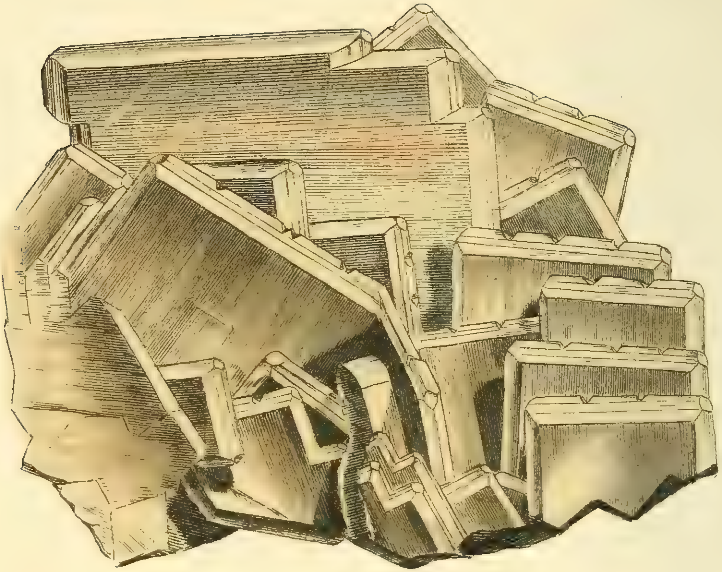

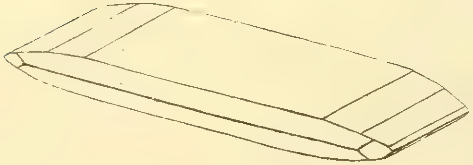

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sure, dilate the prismatic hues, so that one or two sets may take place of the 5 sets represented.

We received this specimen from Durham, by favour of Messrs. Harriman and Oliver, some few years since—but did not know how valuable it was until lately—having now discovered that it contains many small drops of water or some other liquid in little hollows, which as far as we know have never been discovered in any other substance except quartz, or rock crystal.

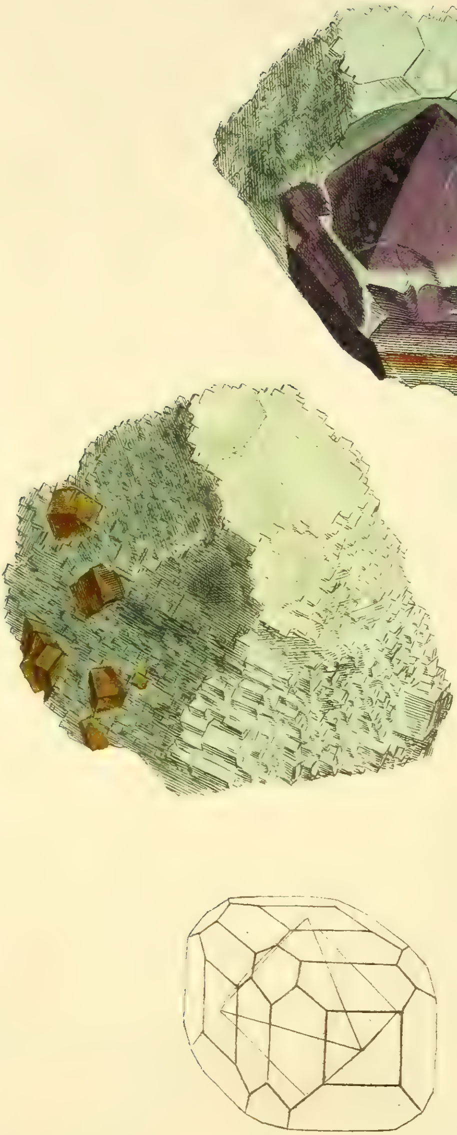
The lower one is another fragment with a curious pearly appearance, and has somewhat the appearance of sulphate of lime or gyps, but may be readily discovered by the weight.

TAB. LXXII.

Tabular sulphate of barytes is the most common variety. The finest specimens generally come from the neighbourhood of Cumberland.

The tabular crystals are sometimes transparent, and often more or less stained with ochre; they mostly stand

upon their edges, often very distinct and in every direction. It may be observed that their edges are parallel to the diagonal of the nucleus, therefore it becomes rectangular. The present specimen has small corner facets, parallel to the faces of the primitive or nucleus. One end has bevelled faces on either side, the angles measuring about 128°, which are parallel to the small triangular facets on the lower figure of Tab. 70. The other has three bevellings. See the geometrical figure.



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TAB. LXXIII.

CALX Fluor, *var.*

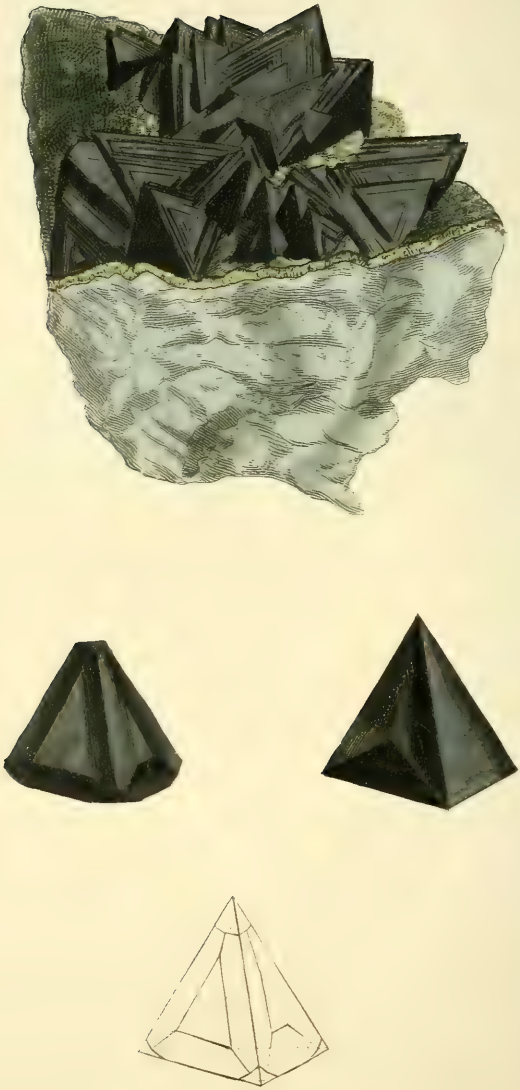
Fluate of Lime, or *Fluor.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 3. Lime. *Spec.* 3. Fluate.

THESE specimens are among the rarest of the fluors known in Great Britain. *The upper one* is in the possession of my very generous friend Philip Rashleigh, Esq. F.R.S. &c. of Menabilly in Cornwall, whose work and grand collection of British minerals are well known. It is an instructive specimen, having the form of a purple octaëdral nucleus withinside, and the green modification in order about it, which adds to its beauty as well as curiosity. One side of this octaëdron has many small but perfect cubico-octaëdrons (or cubes with the corners truncated) of pyrites. The next specimen in value I have the pleasure to possess myself. It is somewhat rougher and rather duller, standing on a confused octaëdron, the corners of which are rather prominent, forming, as it were, irregular steps; it includes a small octaëdron greener than the rest, but rather obscure, within which is a smaller purple one, but which is not to be seen without turning the

specimen about many ways. They both come from St. Agnes in Cornwall.

The lower geometrical figure explains this modification complete, in a position to make it familiar, and to show the placing of the octaëdron, which is in the position of the common fractures of all fluates of lime. See Tab. 27. and the latter part of the corresponding description. The upper middle four-sided face in all the figures will be found to agree with the face of the cube common to fluate of lime; the four sides of which are bevelled off, and the corners, as before mentioned, are parallel to the faces of the octaëdron, they forming six square faces of the cube, eight faces of the octaëdron, and 24 bevellings; in all 38 faces.



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TAB. LXXIV.

ZINCUM sulphuratum.

Sulphuret of Zinc, Blend.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. Zinc. *Spec.* Oxygenized.

Spec. Char. Zinc in combination with sulphur.

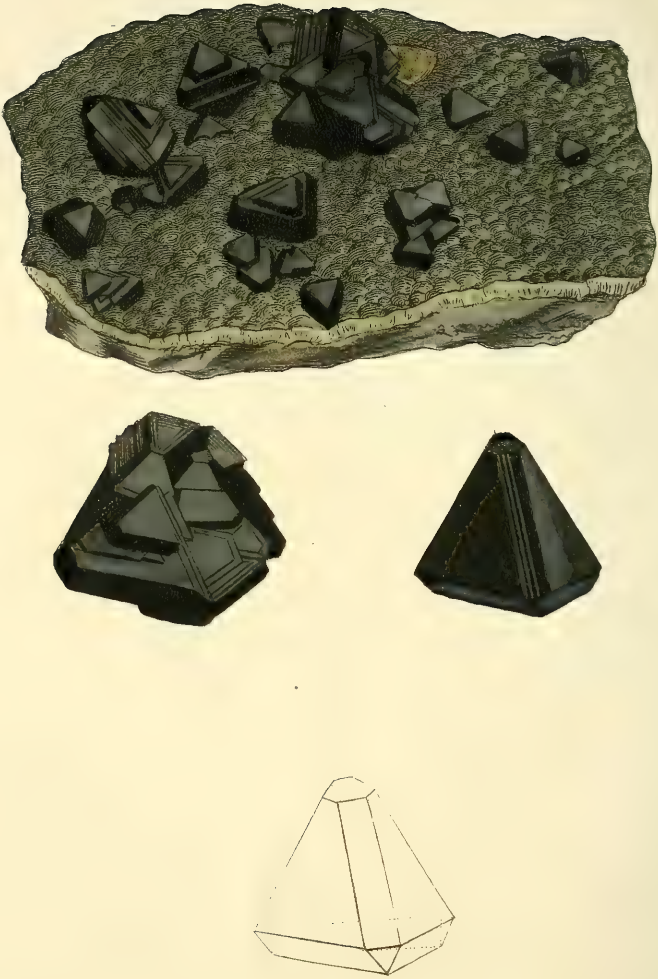
Syn. Zinc mineralized by sulphur with iron. *Kirw.* *v.* 1. 237.

Blende, *Emmerl. v.* 2. 443. *Syst. Min. Jameson*, *v.* 1. 16.

Zinc sulphuré. *Haüy*, *v.* 4. 167.

Blende (commonly called Black Jack by the miners) is often found crystallized, but generally in a very confused manner, and most frequently of a deep jet-black. The tetraëdral variety, here figured, has something of a less deep black lustre, and approaches to a lead-like appearance. Except one or two solitary crystals, they are generally in plated clusters or groups; the plates, for the most part diminishing from the edges to the centre of the triangular faces, forming three faces, as on the dark side of *the right hand figure*. Occasionally, each face of the tetraëdron will differ; and one may either be seen plain, as at the base of the

lowermost geometrical figure, or have the above-mentioned three faces terminating in a point like the dotted faces on the distant side, or with another triangular face like the *right or left hand sides of the same figure*. The truncation of the four solid angles, in the *left hand and the geometrical figure*, are parallel to the octaëdron. These modifications are all evident in the present specimen, which is a Cornish one. They rest on a greenish chlorite, on a light sort of schist or slaty rock, commonly called killas by the Cornish miners. They are often accompanied with rock crystals and copper pyrites. The nucleus is a rhomboidal dodecaëdron, and the integrant molecule is a tetraëdron with isosceles triangular faces, according to Haüy. The modification called *encadré* by that author, among his sulphurets of copper, resembles this very much; but he does not seem to have known such in sulphuret of zinc. Its specific gravity is 4·1665 according to Brisson. It may be scratched with a knife, and it will scratch sulphate of barytes, but not fluor. Refraction simple, *Haüy*.



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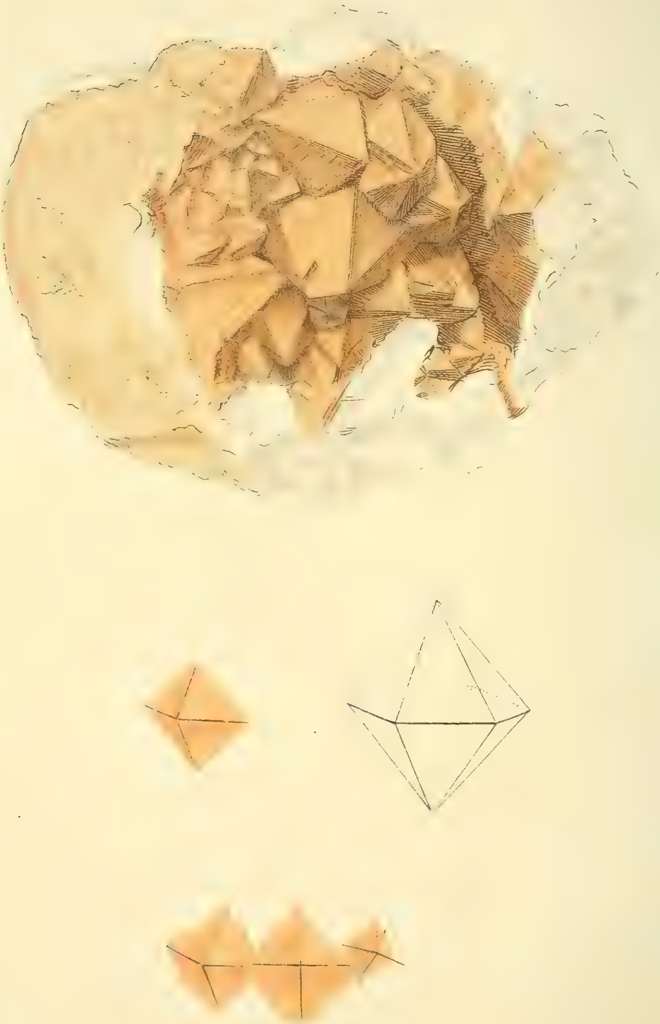
TAB. LXXV.

Is the same substance as the last. The crystallization is a very curious one. The edges being truncated adding 6 faces, which, with the truncations and the solid angles spoken of in the last, make 14 faces. The latter faces may be triangular, like the three bottom ones, or hexangular like that at the top.

These are on a gangue of somewhat dirty green chlorite and quartz, with pyrites.

The nature of the accumulation will be seen when we take occasion to figure the primitive form.

The well known semimetal zinc, often used as a principal agent in galvanism, for making of brass, &c. is extracted from this ore.



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TAB. LXXVI.

BARYTES carbonata.

Carbonate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 1. Carbonate of Barytes.
Div. 1. Crystallized.

GEN. CHAR. Pulverulent, white, somewhat pungent. Spec. Grav. 400. Soluble in most of the acids, and in 900 times its weight of water. Its nitrate does not tinge flame red. Its sulphate is nearly soluble. It forms a hepar with sulphur, which is poisonous. *Bab.*

SPEC. CHAR. Combined with carbonic acid.

SYN. Barolite or aërated barytes. *Kirw. v.* 1. 134.
Witherite. *Syst. Min. Jameson, p.* 573.
Witherit. *Emmerl. v.* 1. 546. *Werner.*
Baryte carbonatée. *Haüy, v.* 2. 308.

WE received the fine specimen here figured, from the lead-mine of F. Hall, Esq. at Arkendale, near Richmond, Yorkshire, by favour of our friend the Rev. J. Harriman, in December 1803. We have since received specimens, from the same place, from Mr. W. Watson of Bakewell, which he gathered in September 1803. It was first found at Angle-

sark in Lancashire only, but has since been observed at several other places.

Carbonate of barytes, it appears, was first discovered by Dr. Withering (see Phil. Trans. for 1784, 301.), when it was called aërated barytes; but Mr. Werner, wishing to honour Dr. Withering for his abilities and accuracy, named it Witherite. It has since very properly been called carbonate of barytes. Radiating carbonate of barytes, in its weight and appearance, very much resembles carbonate of strontia: however, it differs from it in never being of a greenish colour, and in having its radii larger, more compact, and flatter.

The upper figure represents carbonate of barytes in dodecaëdral crystals, formed of two hexaëdral pyramids joined base to base, like quartz.

These are the largest I have seen, and are very rare at present. They are covered with a light ochraceous substance, perhaps calamine. The matrix is carbonate of barytes, in part decomposed, and of a chalky appearance. *The figures below* show the geometrical plan, and in what manner one of the solid angles of the base has been mistaken for part of an octaëdron, or has given the idea of two four-sided pyramids joined base to base, which many have described as one of its forms of crystallization.

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TAB. LXXVII.

CUPRUM sulphuratum.

Sulphuret of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 10. Copper. *Spec.* 4. Sulphuret of Copper.
Div. 1. Crystallized.

SYN. Yellow copper ore. *Kirw. v.* 2. 140.
Copper pyrites. *Syst. Min. Jameson.*
Kupfer-kies. *Emmerl. v.* 2. 232. *Werner.*
Cuivre pyriteux. *Haüy, v.* 3. 529.

THIS copper ore is not uncommon; but the form of the crystallization in this specimen is either rare, or has been hitherto overlooked by most mineralogical writers. Tetraëdrons have been spoken of, but not with lenticular convex faces, which seems a character of this ore when crystallized in tetraëdrons; at least most British specimens have some inclination to convexity. These appear to be always inclined to tarnish, very often assuming a coat, either of the colour of blued steel, or blueish black; and it often has the green patina, or oxide of copper, on the surface, which count Bournon speaks of in his description of yellow copper; *Phil. Trans. for* 1801. When fresh broken it is of a

bright greenish yellow colour with a metallic lustre, and the flaws tarnish to the various colours of what is commonly called Peacock Copper Ore. The fracture is smoothish, having more or less of a fine-grained surface, sometimes like the finest sand, as count Bournon has observed. The crystals are brittle, and too tender to strike fire with steel.

The left hand sides of the two figures show the inclination to form three trapezoidal faces on the triangular ones; and *the figure between two columns of quartz* shows them more plainly, as it does also the signs of the triangular laminæ of superposition. This is taken from another Cornish specimen. *The geometrical figure* shows the somewhat obtuse tetraëdron, each face of which is replaced by three trapezoidal ones, making a dodecaëdron. The nearest modification to this kind is in Romé de l'Isle, *tab.* 1. *fig.* 28. but this has twelve additional isosceles triangular faces. Haüy has a crystal something like this in sulphuret of zinc, which he derives from the rhomboidal dodecaëdron. See his fig. 197. The rounded tetraëdral crystals are therefore passing to the dodecaëdron, in an almost imperceptible manner, as the three figures on the second line show. This specimen has some more perfectly marked, and some truncated like the *two left-hand figures*.

June 1 18[illegible]

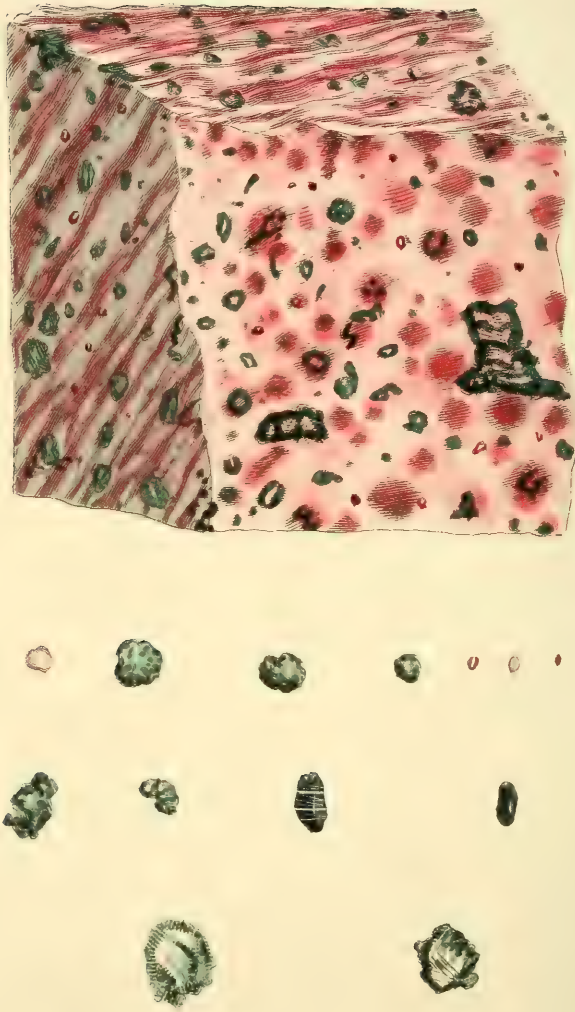
TAB. LXXVIII.

We continue this modification with a very curious variety of the same substance, probably less rich in copper, although differing very little in the lustre or colour of the fresh fracture.

The outward aspect resembles the grey or vitreous copper ores, being of a dull grey colour, and very roughly formed, as it were of certain nuclei, which viewed in the direction of the solid points, or angles, give a peculiar bright shining glare. Its faces are more determined and flatter than in the last: the three trapezoidal ones of the same are not finished (see the *right-hand middle figure*), but leave a triangular face, transverse to the original face of the tetraëdron, forming one equilateral and three isosceles triangular faces on each side, which makes altogether a new sixteen-sided figure. This is a modification very different from any before mentioned. Haüy only finds the modification from the bevelling of the edges of the tetraëdron, as in his grey copper and copper pyrites, tab. 70 and 71, fig. 78 to 89. However, the faces *o* on figs. 81, 85, 86, 87, 88, 89 approach it; but the angle of incidence is that of the rhomboidal dodecaëdron, or 120°; whereas ours is that of the dodecaëdron with isosceles triangular faces. Most of the crystals in this group are truncated at the edges, like *fig.* 27

of Romé de l'Isle (see our *geometrical figure* at the bottom). These sloping truncations add 12 narrow pentagonal faces; and thus we have a new figure with 28 faces.

Copper pyrites may be known from iron pyrites by its brassy colour, smooth fracture, and not striking fire with steel.



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TAB. LXXIX.

CALX carbonata ; *var.* petrosa.

Variegated Limestone ; or *Tirie Marble.*

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 3. Lime. *Spec.* 4. Carbonate of Lime.
Var. 3. Amorphous.

SYN. Common compact limestone. *Syst. Min. Jameson*, 477.

THIS beautiful variegated limestone comes from the hill of Belephetrich in Tirie, one of the western islands of Scotland. It is said to be a primitive limestone, but is not mentioned in Mr. Kirwan's Geological Essays. It has all the common characters of a limestone, with a fine splintery fracture*. It is admired for the white and red, blending and softening into spots, blotches, and undulating striæ, more or less interrupted by bright little red stones sticking within it like little garnets†, which are somewhat transparent, smooth, irregular, and seem to be quartz (see *the lower red-coloured figures*): also white transparent calcareous spar with the common rhomboidal lamellar fracture is occasionally mixed with the stone; but more especially a light or dark olive green substance, either of an earthy or

* Primitive limestone is not always white, nor is the grain of it always very perceptibly scaly or lamellar; but approaches, by reason of its minuteness, so nearly to the compact as to pass for such: nay, it is said sometimes to discover a splintery fracture, but very rarely; sometimes its texture approaches to the fibrous. *Kirwan's Geol. Ess.* 215.

† Jameson says it contains little garnets : we do not find any in the quantity of some tons which we have had the opportunity of examining.

shining appearance. The earthy sort at first sight resembles chlorite, but is more or less rhomboidal in its fracture. It seems to be mixed with quartz, and is irregular as to hardness. This green substance is mostly very irregular as to shape. We could only discover a small inclination to hexangular columns with irregular ends: these are sometimes smooth and shining, and have whitish transverse striæ, which give them the appearance of an onyx: these striæ are softer than the other parts (see *the middle figures*): some of these have a resemblance to jade, as Raspe observed, but perhaps only from their outward smooth aspect. The lighter ones, we presume, differ only in colour, and are probably the same substance; indeed, Jameson calls them all hornblendes. We have had the pleasure, through the kindness of Mr. Hatchett, of seeing the corundum from Tirie, spoken of by Mr. Jameson, and find it the same substance with these crystals, only much lighter in colour: but, as Mr. Greville observes, they are not fusible, as Kirwan and Jameson say hornblende is, therefore they cannot be hornblende; nor are they now supposed to be corundum, although the external appearance of the lighter varieties much resembles that substance. We, at present, only mention these crystals because they occur in the Tirie marble, but must show larger specimens, and explain them further hereafter.

Mr. Jameson in his Mineralogy of Scotland, v. 2. 30. describes the red-coloured marble of Belephetrich as follows:

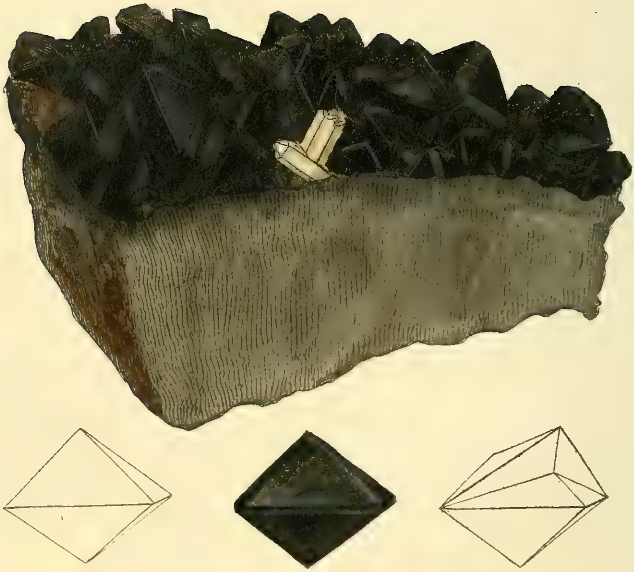
Colour, pale blood red, light flesh red, and reddish white.

Lustre, none, except from a number of dispersed shining foliæ.

Fracture, fine splintery.

Transparency: transmits light freely at the edges.

Hardness: yields pretty easily to the knife.



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TAB. LXXX.

STANNUM oxygenizatum.

Oxygenized Tin.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Tin. *Spec.* 2. Oxygenized Tin.
Div. 1. Crystallized.

Spec. Char. Combined with oxygen.

Octaëdral crystals of oxygenized tin, destitute of any truncations, bevellings, or other modifications, I understand have never been yet found; those here represented are among the nearest known to that simple figure. My friend Mr. Richard Phillips, who possesses one of the finest and earliest collections of tins, &c. from Cornwall, lent me one of his best specimens for this figure, and I am possessed of a similar specimen. They seem in every thing so very like each other, as readily to imply that they came from the same place. They are very black, with much lustre, lying in every direction; some are macled or transposed with various truncations, bevellings, &c. *The middle figure* at the bottom shows the most perfect octaëdron I have yet seen. The edges of the pyramids are truncated more

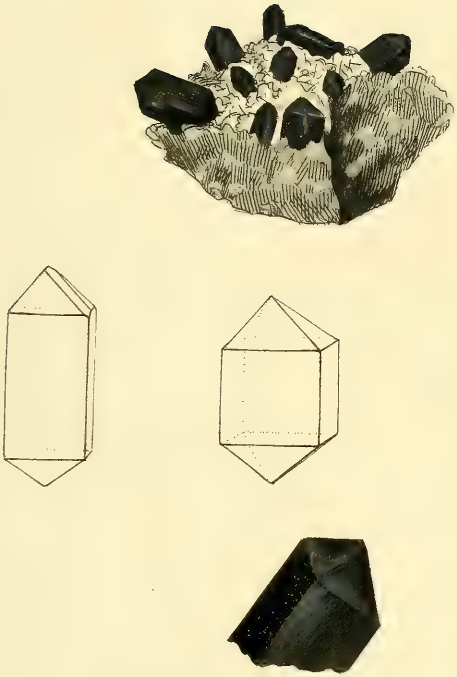
or less; the prism is perhaps shorter than here represented. *The left-hand outline* shows what it should be as a perfect octaëdron. The angles of the base of the two pyramids are 90°. Those of the face at the summit are 70° 31′ 44″, and at the base 54° 44′ 8″.

There have been two opinions concerning the primitive form of oxide of tin: the one, that it is an octaëdron; and the other, that it is a cube. We have obtained very neat fractures parallel to four faces of the latter, and signs of faces inclined upon them, so as to form a rhomboidal dodecaëdron.

TAB. LXXXI.

Good specimens of oxide of tin with the proper four-sided column and corresponding pyramid, if the edges are not bevelled, or truncated, are somewhat rare. Some crystals on the present specimen are of this form, and others are truncated on the edge of the column, making a fifth face; which truncation is generally continued up the edge of the pyramid.

A four-sided column without truncations, or a pyramid, would be a great curiosity.



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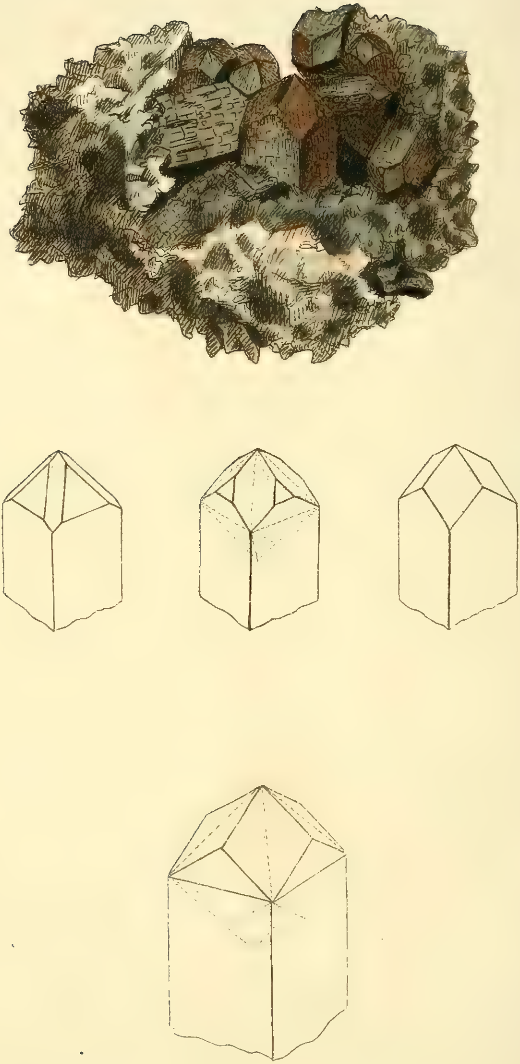

TAB. LXXXII.

The figures here represented approach the dodecaēdron as nearly as any that I have yet met with of British origin. It will be readily seen that the edges of the four-sided pyramid, as truncated on *the left-hand figure*, if continued so as to obliterate the octaëdral faces, would form, with the help of the four-sided column, eight of the faces of the dodecaëdron, the other four faces being hid in the gangue; and, if with a short column, the faces would be all rhomboidal; but if the column be long, the columnar faces will be hexagonal. As yet we have not seen a dodecaëdron with both pyramids complete. These specimens are not so black as most, and are modified very roughly. They have also somewhat of a rusty ochraceous hue, probably holding more oxidated iron than usual.

We are obliged for this specimen to our friend Mr. Richard Phillips. We have some like it, but much smaller.

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TAB. LXXXIII.

SILEX Quartzum.

Agate Pebbles.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartz.
Div. 3. Amorphous.

Syn. Quartz agathe spheroidal. *Haüy*, *v.* 2. 423.

Agate appears to be a very antient name given to this kind of quartzose stone. It is found on many parts of our shore, as at the Bill of Portland, Lowestoft, and on the Welsh, Scotch, and Irish coasts. It is sometimes found inland, about the lochs in Scotland and Ireland; and, occasionally, in the gravel-pits about London, &c.

This species has been much admired for its resemblance to many oriental stones; and differs from our common pebbles by its toughness, which preserves it from large internal flaws. According to its transparency or colour it is more or less valuable, depending on the taste of the owner. Such productions often become pledges of regard, or memorandums of past hours employed in gathering them; and are thus more esteemed than for their intrinsic value.

Exclusive of these social ideas, they are often equal to the best foreign agates, and bear cutting and polishing equally well. We shall speak of the striped and otherwise marked stones hereafter.

The agates found on the sea-coast, being rolled and jumbled together by the force of the waves, are roughened; but being hard, this roughness penetrates but a little way, and the utmost force they experience seems only to make little circular flaws; or, if I may be allowed the expression, more frequently little crescents or semi-circular flaws, from the impulse of the blow coming in a lateral direction.

The right hand specimen is from the Bill of Portland. Its outer surface is generally as here represented, but sometimes whiter. *The left hand top specimen* came from Lowestoft, and was, perhaps, formed by aggregation, as most agates seem to be (possibly in a trap rock, see Tab. 58), as the cloudy appearance within seems to indicate.

The next figure is of a rougher formation. It was sent by the Rev. H. Davies of North Wales. *The smooth one on the right hand,* with a little red about it, has been called a carnelian. It was found at Lough Neagh in Ireland: but it must be observed that agates, especially British ones, should not be confounded with oriental carnelians, the fracture of the agate not being so shining, and the stone much harder*. *The next specimen on the left* is a rather pellucid fragment

* This is well known to lapidaries, seal engravers, &c. as it costs them more labour and diamond dust to work them.

with the edges partly blunted. *The inner figure on the same line* was given me by Mrs. Abbot of Bédford, who picked it up in Derbyshire. The smallest of the two lowest ones is apparently a fragment, remarkable for the resemblance to part of a septarium; the inner part resembling *the upper right hand figure* with a coat of a different colour. *The largest figure at the bottom* has a resin-like appearance, which these stones occasionally have, and was given me by D. Turner, Esq. who brought it from Ireland. Agates that are found in Scotland resemble all these; but what are found there, especially near Perth, are admired for being striped, zoned, forming onyxes, or speckled with various blots, &c. resembling eyes. Mocoas are a sort of agate with dendrites or figures like sprigs, trees, &c. which seem to be iron, some say manganese, formed in a peculiar manner with the stones, especially the oriental ones, which are durable; but those called German Mocoas by the lapidaries, seem to have had the branching figures introduced by nature or art into their flaws, and such are apt to disappear, often to the great disappointment of the wearer. We digress a little in speaking of these, which are foreign subjects, as we do not yet know of any stones worthy to be termed Mocoas found in Great Britain.

We consider agate to be nearly of the same nature or a variety of chalcedony. It is said to contain Silex 84, Argil 16.

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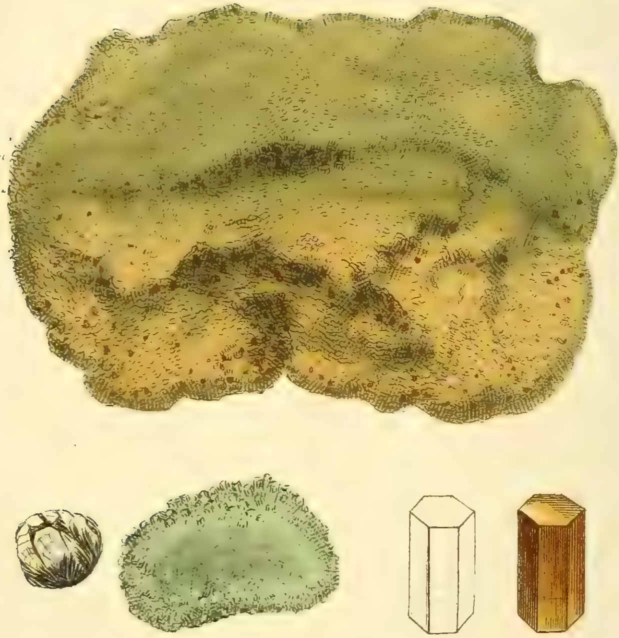

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TAB. LXXXIV.

PLUMBUM phosphatum.

Phosphate of Lead.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 14. Lead. *Spec.* 3. Phosphate of Lead.
Div. 1. Crystallized.

Spec. Char. Combined with Phosphoric acid.

Syn. Phosphorated Lead ore. *Kirw.* v. 2. 207.
Grun-bleyerz. *Emmerl.* v. 2. 394.
Braun-bleierz. *Ibid.* 383.
Green Lead ore. *Syst. Min. Jameson.*
Plomb phosphatée. *Haüy*, v. 3. 491.

The yellow phosphates of lead of Wanloch-head mines, Scotland, are found coating Galæna in the Bellan-grain vein, from 20 to 30 fathoms below the surface, but gradually disappear at greater depths. From this mine our specimens came by favour of G. Laing, Esq. They are found in other parts of Great Britain besides Scotland, as Wales, Cornwall, Ireland, &c. The purest phosphates seem to be of the brightest yellow, and the crystals are generally very small, being mostly hexaëdral columns and their modifica-

tions. The present is in very perfect hexaëdral columns, and its yellow varies in intensity, with a greenish and brownish cast. The crystals are soft, brittle, easily scraped with a knife, and the powder* corresponds with the colour of the crystal. The crystals will easily scratch carbonate of lead. Fracture splintery and conchoidal. "Integrant molecule an irregular tetraëdron. Primitive form a bipyramidal dodecaëdron."—*Haüy*. We find these at first, by exposure to the blowpipe, turn green; then they assume a pearly cream colour, and afterwards become irregularly fibrous. The heat being continued, these fibres unite in a somewhat concentrating manner, forming various polygonal facets in an irregular sort of crystallization: see *the left hand figure* at the bottom. This substance is sometimes situated on an amorphous matrix of its own nature, or on quartz, ochraceous quartz, galæna, &c., as before observed.

* It is said to be gray by Haüy, let the colour of the mass be what it will.

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TAB. LXXXV.

STANNUM oxygenizatum.

Oxide of Tin, in Crystals with 8-sided Pyramids.

Etain oxydé opposite. *Haüy*, *v.* 4. 141.

THIS is a rare modification. It is an incomplete 8-sided pyramid placed upon a 4-sided prism, at an angle of 155° according to Romé de l'Isle, and of 158° 45′ 27″ according to Haüy.

This pyramid is always terminated by another 4-sided one parallel to the octaëdron. They either stand on the gangue upright, with one end only finished pyramidally, as appears from the *middle figure on the right hand*, which is a large and curious detached crystal: being broken at the top, it gives an indication of a point, but on examination we find it cased on an octaëdron, which probably it once covered regularly; or they lie on their sides and are pointed at both ends: see *the left hand figure.* They are seldom large. The gangue is as usual to tin crystals, viz. rock crystal, chlorite, and chlorite schist, or *killas* of the Cornish

miners. *The geometrical outline on the left hand* shows the commencement of the 8-sided pyramid on the edge of the prism. There are many varieties of this modification on this specimen, and sometimes of two them meet base to base, and form a mackle: see *the bottom figure.*

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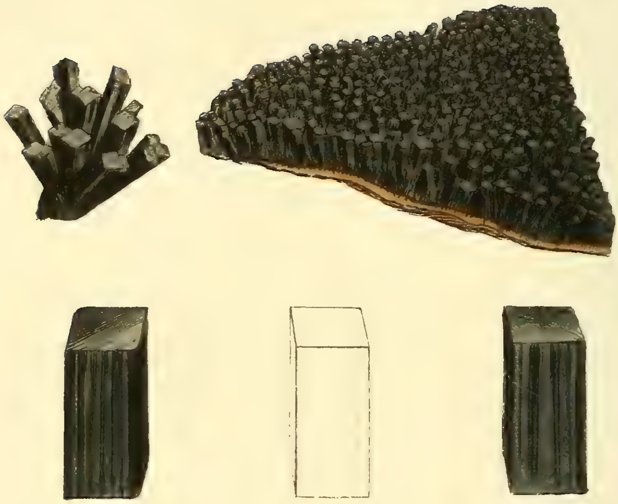


TAB. LXXXVI.

MANGANESIUM oxygenizatum, *var.* Primitivum.

Oxide of Manganese.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 2. Manganese. *Spec.* 2. Oxide.
Div. 1. Crystallized. *Var.* 1. Crystal primitive.

GEN. CHAR. Spec. Grav. 6.85, somewhat malleable. Colour grayish white, very difficult of fusion, even more so than iron. Colours glass violet. Does not combine with sulphur.

SPEC. CHAR. Combined with oxygen.

SYN. Manganese mineralized by oxygen, *Kirw. v.* 2. 291.

Gray manganese ore, *Syst. Min. Jameson.*

Braunstein. *Emmerl. v.* 2. 522.

Manganese oxydé. *Haüy*, *v.* 4. 243.

MANGANESE (which was first discovered to be a new metal by Bergman), and which has since been found in a native state by Mr. La Perouse, in the valley of Vicdessos, near Sem, in the neighbourhood of Foix, Pyrénees, who

3

says it is imbedded in oxide of manganese; is of a silver gray colour with a metallic lustre; divergingly foliated texture, somewhat malleable, and that it soils the fingers. Not knowing of its being found hitherto in Great Britain, we give this short account of it, and shall be glad to be favoured with any specimens which may be met with hereafter. We describe with much pleasure the present specimen of crystallized oxide, as propitious to an expectation that Great Britan nearly includes all that is essential to a knowledge of mineralogy, very few genera being excepted.

Mines have been worked in many parts of Great Britain for oxide of manganese. I have some specimens from Mendip Hills in Somersetshire, crystallized in small short rhomboidal prisms. The one figured is crystallized in elongated ones, which have striæ on their sides that agree with the fracture. We also find the apex show signs of a diëdral or tetraëdral summit.

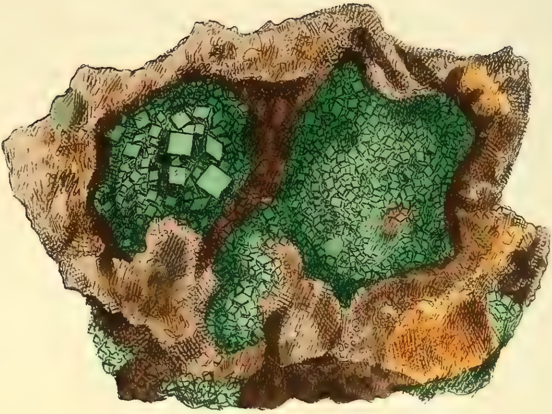
The upper right hand figure is nearly the natural appearance and size of the specimen; the prisms standing irregularly and joining near the base, where they stand upon sulphate of barytes, &c. The gangue is a sort of stratified micaceous grit, through a stratum of which it runs in veins. In a mass sent me from Aberdeen, the manganese includes crystallized sulphate of barytes, &c. as trap sometimes does other stones. *The left hand upper figure* is magnified, and shows how irregularly the crystals stand on the mass in some parts. *The left hand bottom figure* shows

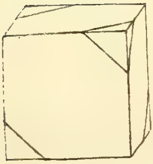
the upright striæ on the prism, and the apex exhibits the diagonal striæ, and on some crystals a slight beginning of the two faces which sometimes meet on the centre. *The left hand figure* shows these striæ meeting in four directions to the centre, with the cross diagonals, giving signs of 4 or more faces. The prism is sometimes truncated so as to form eight sides. Haüy knew of no other than these eight-sided ones, with 2 or 4 summits at the apex.

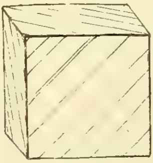
We first read of short tetraëdral prisms of oxide of manganese in *Catal. de Raab. v.* 2. 130, from Naila, in the margravate of Bareith, in Germany, and soon after of rhomboidal tetraëdral prisms, neatly truncated at their extremities, from Ilmenau in Saxony. These of course are in Mr. Greville's matchless collection; we find the latter mentioned, as from Ilfield, in Dr. Babington's catalogue of the collection, now belonging to sir John St. Aubin, p. 255. We are glad to be possessed of British specimens from the works near Aberdeen, which I have been given to understand were first discovered by the Rev. Mr. Smith. My friend, Mr. James Reid, among other similar favours, procured me the specimen figured, some time in the year 1803. It agrees exactly with the two last specimens mentioned in *Catal. de Raab.*, in which the word truncated is certainly superfluous, rhomboidal prisms simply, being assuredly meant. This is considered as the primitive form by Haüy.

Oxide of manganese is used in glass-houses in small quantities, to clear and discolour glass by giving up some of

its oxygen, and so completing the vitrification of the iron or other colouring ingredients. It is used as a pigment or an ingredient in printer's ink, and to procure oxygen gas from, for many purposes, viz. as a medicine; or for oxygenizing muriatic acid for bleaching, &c. About two quarts of this gas may be obtained from an ounce of oxide of manganese.







Augt 1 1804 Published by Jas Sowerby London.

TAB. LXXXVII.

FERRUM arseniatum.

Arseniate of Iron.

Class 3. Metals. *Ord.* 1. Homogeneous.
Gen. 6. Iron. *Spec.* 8. Arseniate.
Div. 1. Crystallized. *Var.* Primitive.

SPEC. CHAR. Combined with arsenic acid.

SYN. Arseniate of Iron. *Bournon in Phil. Trans.* 1801.

THIS was mostly confounded with arseniate of copper until the celebrated Chenevix, by analysis, ascertained it to be an arseniate of iron: see Phil. Trans. for 1801. Count Bournon observes that it crystallizes in cubes rarely a little flattened: I may add rarely lengthened. I, however, have it a little so, perhaps the fourth of its diameter; and his figure conveys that idea, although I suppose unintentionally. The sides, he observes, are smooth and brilliant. I am happy to add another character, that they are diagonally striated in alternate order on each face; this is readily seen in most of my specimens*. They are often a little concave in the centre, and rising to the edges in the longitudinal direction of the striæ, and also show signs of being formed on cubical nuclei. I have them from a light yellowish

* See Ferrum sulphureum, tab. 63, in which the striæ are parallel to the edges of the cube; and Count Bournon has discovered a new species of cubic oxide of iron with the striæ at right angles, parallel to every edge of the cube: perhaps these striæ may become marks of importance

green to a bright perfect green, apparently neither inclining to yellow or blue, passing on to deepish blue green, and thence to an olive colour, being heightened, as it were, with red; then, the yellow and red prevailing, they are of a brownish resin colour: some are very pellucid and transparent, and all so in some degree. *The upper figure* shows them of their common natural size in a gangue of quartz mixed with oxides of copper and iron, &c. *The middle figure* is magnified to show their construction more readily; and *the right hand geometrical figure* shows the striæ. *In the left hand bottom figure,* the only modification known of this substance, according to count Bournon (to use his own words), "Four of the eight solid angles of the cube are replaced by an equal number of equilateral triangular planes, situated in such a manner that every one of the sides of the cube becomes an elongated hexagon, having two angles of 90° each, and four of 135°. Crystals modified in this way are very scarce. I have never seen but one specimen, which is in the collection of sir John St. Aubin. Its crystals are pretty large and well defined." I therefore consider as a great rarity a specimen in my museum, which exposes two crystals thus truncated. It is easily scratched with a pin, but it scratches common calcareous spar. By Chenevix's analysis it was found to contain

Silica - - -	4
Arsenic acid -	31
Oxide of Iron -	45·5
—— of Copper	9
Water - - -	10·5
	100·0

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TAB. LXXXVIII.

SILEX Quartzum.

Flint Pebbles, &c.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 4. Silex. *Spec.* 1. Quartz.
Div. 3. Amorphous.

SYN. Flint. *Kirw. v.* 1. 301.
Feuer Stein. *Emmerl. v.* 1. 143.
Quartz agathe pyromaque. *Haüy, v.* 2. 427.

FLINT pebbles, so universally known in the vicinity of London, are not so well known every where, even in Great Britain, since one may travel many miles in some counties without finding any.

The forms and colours of common flints are extremely various, and they give strong indications of being formed by infiltration and aggregation among the softer argillaceous rocks; as the agates, &c. seem to be among the harder rocks of a similar natrue; see p. 170: the siliceous infiltration being more or less coloured by oxide of iron, gravitates, or aggregates, into various forms.

The upper pebble at the right hand is white at one end, gradually becoming grayer towards the other end, with a

line or two of interruption, and at length assuming the colour and texture of common gray flint*. The uncoloured part is sometimes less indurated, but insoluble in acid, and seems only destitute of the colouring matter. The coat appears to have been formed when the process was nearly complete; as drops of coloured water, or turpentine, will, in general, form a margin in the same manner on substances on which they are put: the others seem formed in a similar way, varying as to regularity. An approach to yellow, with a border of dull crimson, is seen in the next stone, and the coat is nearly black with very little variety.

The next right hand figure was given me by a friend who found it near Norwich. It is remarkable for the uniformity of the ochraceous tint all through it, and the dark coat penetrating it in the cracks, which seems to confirm the idea of the margin being formed as the substance was beginning to harden. The next stone is very regularly formed. In this, one of the circles is of as true a yellow, and nearly as bright, as I have ever found in flints. The faces of broken flints sometimes become of a brighter yellow when they have been exposed to the air. The upper central one is more irregular, but is in the middle as bright a cinnabar, or vermilion, as can perhaps be found in these sort of stones, and resembles red jasper. The fragment beneath has been

* The common ingredients are	Silex	-	80
	Argil	-	18
	Lime	-	2
			100

irregularly modified. It is of the brightest crimson in the centre. *The lower left hand figure* is uniformly of a red jasper colour, which is not very frequent. Its fracture shows it to be not so tough and hard as jasper. This is rather partially covered with an ochraceous hue. The grey and black flints are not very rare: they are mostly found in wet clayey places, and are often very black, sometimes shining, or blotched with grey or a whitish hue; and, when so, are mostly lighter within under the black outside, and darker under the grey outside.

Pebbles, if of a fine ochrey hue, from the size of a horse-bean to that of a Windsor-bean, are used for making foot-ways or walks in our best gardens; and are sold in the vicinity of London from 10 to 12 shillings per load, under the name of gravel; the coarser sort are used to mend the roads*.

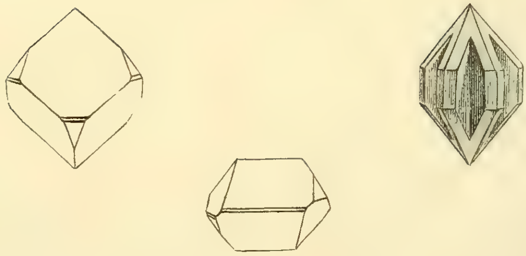
They are often useful, as at Sandown Castle, near Deal, to defend the coast from the encroaching ocean. They are certainly of more use than they are imagined to be in agriculture†; and protect the vegetable earth from the violence of the high winds, while they retain the night-

* It might be observed that they should not be brought from the damp pits in which they are found to sudden heat or cold, as it makes them rotten, unless intended to be rendered so for manure.

† Soil may be amended by the judicious farmer by adding or diminishing their quantity according to what he wishes to cultivate; their composition, size, sponginess, softness, hardness, and even shape, are of much consequence.

fallen dews and moisture necessary for vegetation. They also defend the roots from the too sudden and scorching heat of the sun in the day. They seem admirably suited for this purpose, as their texture is such as to imbibe heat rather slowly. Thus their being common is a happy providence, and it is very reasonable to suppose that every pebble has its destined use.

A great deal more might be mentioned respecting their utility in agriculture; but if what has been said is attended to, it will be found sufficient in this place. We may observe that, when free from flaws and of a good colour, they will bear cutting, engraving, and polishing, as well as the oriental carnelians, which they partly resemble in their shining fracture, and almost equal hardness.



TAB. LXXXIX.

PLUMBUM carbonatum.

Carbonate of Lead.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 13. Lead. *Spec.* 2. Carbonate.
Div. 1. Crystallized.

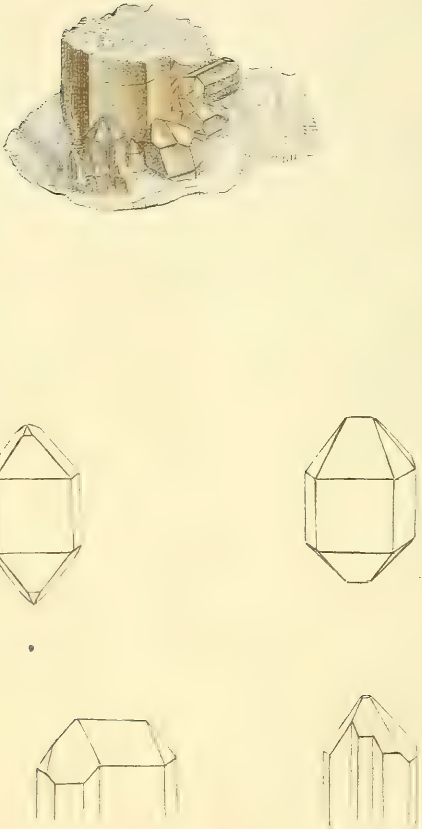
SPEC. CHAR. Combined with carbonic acid.

SYN. White lead ore. *Kirw. v.* 2. 203. *Jameson.*
Weisses bleierz. *Emmerl. v.* 2. 388.
Mine de plomb blanche. *De Lisle, v.* 3. 380.
Plomb carbonaté. *Haüy, v.* 3. 475.

CARBONATE of lead has often a great resemblance to carbonate and sulphate of barytes. It has, however, the advantage of weight, is generally more milky in its appearance, and is mostly shorter in the cross fracture; it is also softer. When crystallized, it is more deceptive, assuming the double pyramidal dodecaëdron of quartz. It is however most readily to be scratched with a knife, which quartz will not admit of; and when carefully examined, there are very few specimens of this sort that do not indicate a very curious tendency to forming one crystal out of many plated ones. These plates are often so placed that it is difficult to

see the modification, especially to an unpractised observer. They often imitate the plated crystals of sulphate of barytes. The present specimen is a very fine one, obtained some years since. This shows that they sometimes originate from the decomposition of galæna, and they are here yet coloured with it. The matrix is composed of galæna mixed with fluor. This very curious specimen has the first modification of the quartz-like crystal, deduced from the primitive rhomb (see *the left hand outline*), with the column just visible: these pass into regular dodecaëdrons, with very short columns, or rather octo-decaëdrons; and also form the same figure in plates, which, if regular, show the surfaces of 12 intersecting planes or facets: see *the right hand lower figure:* but these are seldom quite regular, and they may be so confused and indeterminate that we cannot make them out: see *tab.* 90. *The under figure* is a modification seen on the same specimen, formed by the primitive before spoken of, having a larger deposition on some of the faces than on others, which gives it a lengthened appearance.

Analysis by Westrumb:	Oxide of lead		81·2
	Carbonic acid	-	16·0
	Lime	- -	0·9
	Oxide of iron	-	0·3
	Loss	- -	1·6
			100·0



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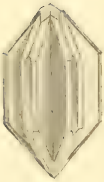

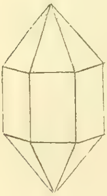

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TAB. XC.

The specimen here represented would, very naturally, be taken for one of quartz, which it much resembles; and perhaps it might be passed over by casual observation as such. It came from the lead hills near Glasgow, and is very valuable. It is figured of the natural size, and has part of a large hexaëdral column very distinct, with many eighteen-sided crystals, either like the outline in the middle at the right hand, or like the lower figure at the right hand, with the column interrupted as it were in its formation, giving them the appearance of the buttresses often used in Gothic architecture, and adding many faces to the sides of the crystal, as well as giving additional angles to the faces of the pyramid. They vary much; one is nearly like *the left hand bottom figure* with 13 faces, having a pyramid at one end only.

TAB. XCI.

This specimen, lately sent me, by favour of Mr. Laing, from Wanlock Head mines, near Glasgow, shows the disposition of the last mentioned substance to form plated octo-decaëdrons and other modifications, inclining to the appearance of sulphate of barytes, by forming a sort of truncation on the edges. Thus *the left hand figure* is truncated

on the edges of the original six-sided column, forming six-sided faces : see the dotted lines on the column of *the right hand figure*, and also the apex which is terminated by six trapezoidal faces. Thus we should have 48 faces if they were regular; this is certainly a curious modification. Mr. Laing judiciously observed, that the sulphuret of lead, or galæna, in most cases, where it is decomposing to form carbonate of lead, has a blue tarnish. It sometimes also becomes dusty or crumbly.

[illegible]

TAB. XCII.

SILEX Quartzum, var. aggregatum.

Quartzose Pudding Stone.

Class 2. Earths. *Order* 3. Aggregated.
Gen. 2. Silex. *Spec.* 1. Quartzose.

Syn. Pudding Stone. *Kirw. v.* 1. 360. *Bab.* 131.
Quartz-agathe breche. *Haüy, v.* 4. 461.
Poudding. *R. De Lisle, v.* 2. 481.

This is not rare, in gravel-pits, in many counties of England; Hertfordshire is however most famous for producing it. Pudding Stone is little known abroad, and is therefore esteemed in Germany, and other parts of the continent, as an English rarity. I believe it is not found either in Scotland or Ireland *.

The most perfect and most esteemed specimens are those which have the closest and finest siliceous cement, with the greatest number of variegated pebbles, sometimes with fanciful representations: see *left hand part of the figure.*

They are much the same in texture and hardness throughout, as the flint pebbles figured in *tab.* 88, and bear a polish equally well with them.

The upper figure is one of this sort, but is better in some parts than in others. The sides show an imperfection, as

* Though in Scotland they call some of the rocks by this name.

some of the pebbles are broken out, having been rather moulded than cemented, and almost loose when found. This specimen, I believe, is from Hertfordshire, where some people assert that they grow! This kind of stone was greatly sought after about a century ago, to be cut into trinkets, snuff-boxes, coat-buttons, &c.

The lower specimen came from South-end, Essex, and was given me by Lady Wilson. The opposite shore, at Sheppy Island, Kent, has many varieties of it, probably washed out of the curious marle clifts of that place. This specimen is somewhat too sandy, and not close-grained enough to bear a polish. They are sometimes found very large, and I have seen fragments of them that must have been several feet in diameter, which had been formerly worked into querns to grind corn.

Probably the name was given by English lapidaries; and, as Mr. Kirwan observes, they meant, by the appellation of Pudding Stones, to express flint pebbles of any colour cemented with a substance of the same or a similar hardness, so as to make an equally compact stone for polishing.

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TAB. XCIII.

CUPRUM arseniatum.

Arseniate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 9. Copper. *Spec.* 8. Arseniate.

SYN. Bournon. *Phil. Trans. for* 1802.

THIS beautiful specimen of Arseniate of Copper was lent me by my good friend Philip Rashleigh, Esq. of Menabilly. It comes from near Gwenap. The crystals are spoken of by Count de Bournon as his third variety, "perfectly regular for a part of their length, and fibrous at their extremity." The present specimen has these crystals with apparently four sides of the octaëdron, lengthened into filaments, and divaricating a little from a centre, forming altogether a sort of brush, narrow at the base, widening towards the apex, and terminating a little abruptly in a sharp or angular point. They are of a dark dull green, somewhat transparent, the ends being generally more opaque and lighter, owing to their fibrous nature : some crystals

are of a darker green colour and more confused: see *the left hand figure.*

The gangue is chiefly quartz, somewhat plated and ochrey, and has intermixed with it bright green arseniate? of copper in irregular granulæ: see *the right hand figure.*

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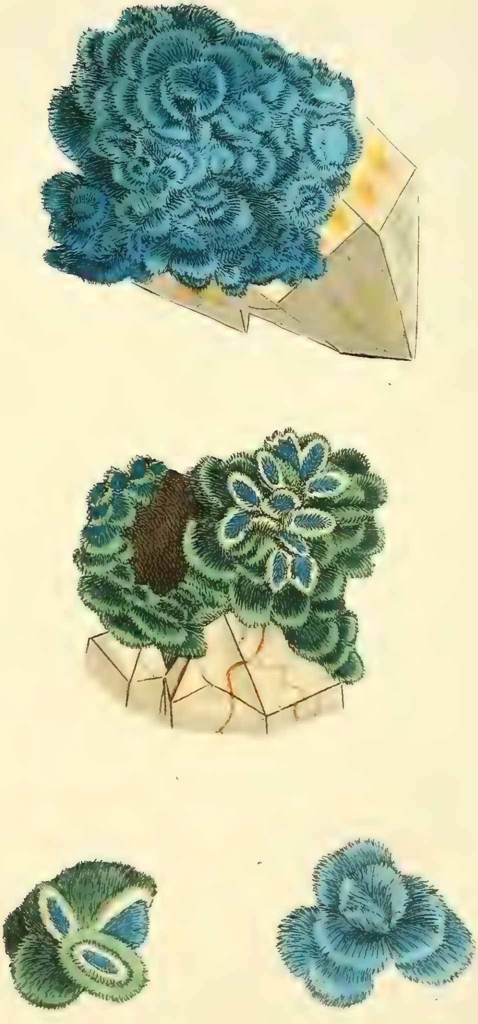


TAB. XCIV.

CUPRUM carbonatum.

Carbonate of Copper.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 9. Copper. *Spec.* 3. Carbonate.
Div. 2. Imitative.

THE present specimen is a very rare and curious modification of carbonate of copper.

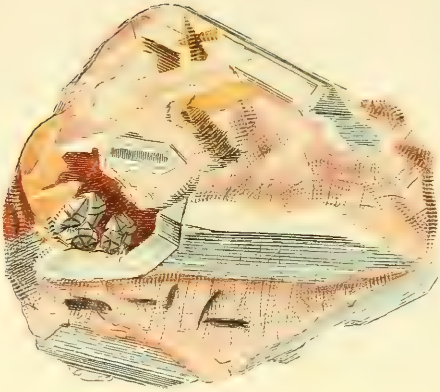
At present I know of only two specimens; one belonging to P. Rashleigh, Esq., and the other in the possession of Mr. R. Phillips.

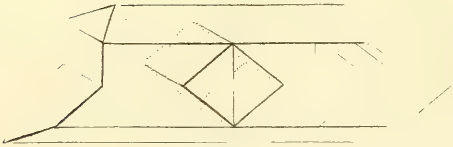
The upper figure, which belongs to the former gentleman, is, as he observes, remarkable for being on the broken end of a large milky rock crystal. The other stands on the crystallized ends of the rock crystal, and is a much larger specimen; part of it only being figured.

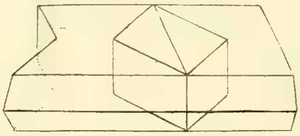
This mineral was first considered as an arseniate of copper, but we have every reason to suppose it to be a carbonate.

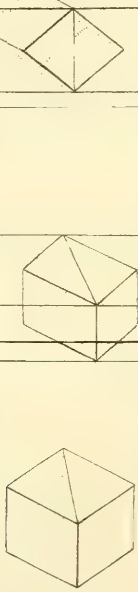
The spiculæ are curiously disposed like radii round the edges of a thickish lenticular nucleus.

Both specimens are accompanied by a few crystals of each variety of arseniate of copper, figured at *tab.* 31.









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TAB. XCV.

BARYTES sulfata.

Sulphate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* 2. Sulphate.
Div. 1. Crystallized.

THIS curious specimen was sent me from Cumberhead lead mine, at the head of the Nethan river, in Ayr-shire, by G. Laing, Esq. It is remarkable for the crystallized sulphate of barytes being immersed in amorphous sulphate of barytes. Not having before seen a fracture that indicates the integrant molecule, we are glad to make use of this specimen to show the form of one.

It is certainly very rarely to be fractured parallel to all its faces, some of which are not at all to be seen, and it should seem that Haüy had only observed them by the scintillations within the crystal. To explain the nature of the crystals formed in *the upper figure,* we have drawn a distinct outline in *the middle one,* including the nucleus, to show its situation. It will be easily seen that the perpen-

3

dicular face at *the left hand* end* is parallel to the diagonal division of the nucleus, and the oblique fracture is parallel to one of the faces of the rhomboidal prism; the perpendicular lines indicate a continuance of the diagonal fracture, the others a continuation of the rhomboidal fracture. These are extended in the specimen more or less perceptibly until lost in small nuclei, at the right hand end of the crystallization.

The third figure may help to familiarise these things by its being placed in another position, and showing similar facts. *The lower figure* shows the geometrical divisions of the nucleus into two molecules, by means of this fracture parallel to the shortest diagonal of the rhomb.

Having seen this, we cannot doubt the opinion of Haüy, that there may be a fracture parallel to the longer diagonal, dividing the molecules above mentioned into two: thus four upright triangular prisms form the rhomboidal prism or nucleus, each being an integrant molecule.

* The faces at this end are all fractured ones.

TAB. XCVI.

Div. 2. Imitative.

This variety of sulphate of barytes has obtained the name of cauk among the miners; for what reason I do not know. It has also been called terra ponderosa. The sort here figured is very frequent in Ecton mine, Staffordshire. It is not uncommon in other places, but of a less regular sphærical form. It is generally accompanied by carbonate of lime, fluor, galæna, blend, iron and copper pyrites, &c., and is most frequently white. Sometimes it is coloured by oxide of iron, and is then either yellowish, or mostly reddish. The specimen represented in the *upper figure* came from Ecton mine, and is accompanied by calcareous spar and pyrites of various forms and hues. The internal structure is confusedly laminated, showing signs of crystallization, arranged in the form of a sphere; these laminæ are extremely close, and often confused, or so thin that no determinate form can be made out, having only the appearance of segments of circular plates, sticking edgeway by the side of each other: see the *bottom figure:* at other times they are the edges of plates with the faces usual to tabular sulphate of barytes; see *tab.* 72. The whole are

sometimes attached by a greater or smaller base, so as to be nearly detached spheres; at other times only half a sphere or less.

At Buxton, Derbyshire, however, detached balls are found, not far under the surface of the common earth: see *the three figures in the middle*. They seem to be formed among loam, and partake of an ochraceous hue; the edges are frequently more separated, and less regularly rounded. They have occasionally attached to them single cubic crystals of fluor in a decomposing state; of which more hereafter.

These are somewhat related to the celebrated Bolognian stone, which shines like phosphorus in the dark; and if heated red hot in a common fire, it is said to assume the same property. They are allied also to the liver-stone *, which has its name from its hepatic scent, derived from sulphuret of ammonia or liver of sulphur. Varieties are found in Great Britain, which, when rubbed, give nearly the odour of stink-stone: see *tab.* 38.

* Found in Adrarium, in Scania.

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TAB. XCVII.

FERRUM arseniatum.

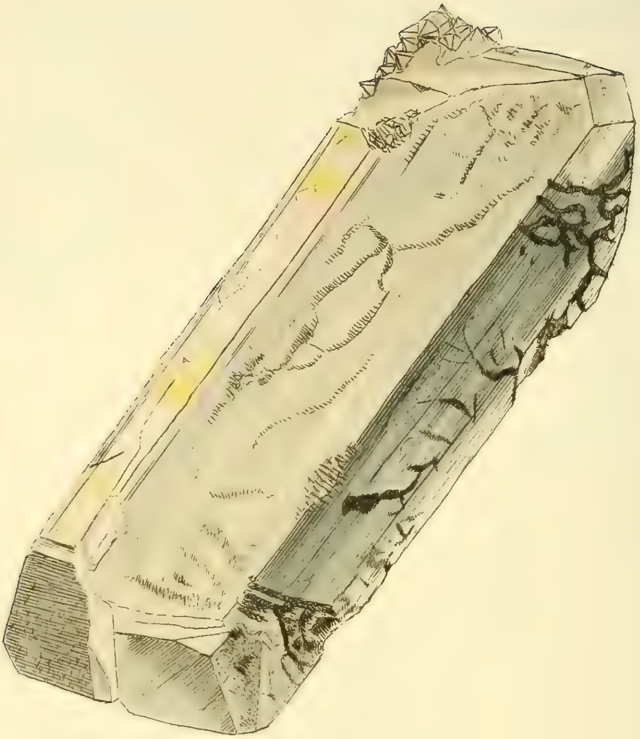
Arseniate of Iron.

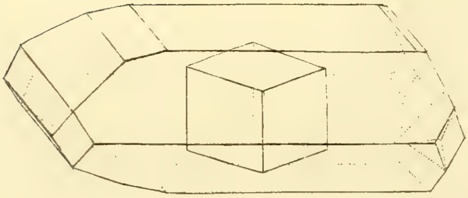
Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Iron. *Spec.* 8. Arseniate.
Div. 1. Crystallized. *Var.* 7. Primitive.

THIS arseniate of iron is one of the richest that has been seen hitherto; and what adds much to the beauty of the specimen is, that the lighter green cubes are accumulated in groups, forming threads, lying on darker ones, all of which are very pellucid. To add to the rarity of this specimen, we find extremely fine fibres of an oxide of iron? partly encircled by a band as it were of the arseniate, which relieves the reddish brown dusty appearance of the oxide; and this last, in return, relieves the glittering arseniate. The fibres of the oxide are so fine that it requires a high magnifier to see them; we could not discover any other than simple fibres. *The top figure* is of the natural size;

the middle one, somewhat magnified; *the lower* are more magnified. The gangue is chiefly quartz, with various coloured ochres and some arsenical iron, or what has been called mispickel: see the metallic parts in *the upper figure.*

This is one of the many fine specimens in Mr. Rashleigh's collection.





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TAB. XCVIII.

BARYTES sulphata.

Sulphate of Barytes.

Class 2. Earths. *Order* 1. Homogeneous.
Gen. 6. Barytes. *Spec.* Sulphate.
Div. 1. Crystallized.

The specimen from which this figure was taken is in the collection of Mr. Professor Hailstone at Cambridge, to whom it was presented by John Probart, Esq., of Copthorne near Shrewsbury, in whose interesting museum the Professor saw several other crystals of the same kind, but of larger dimensions, and understood that they were found in some part of Shropshire; but he had no opportunity of ascertaining any further particulars respecting their native beds, and situation in the earth.

It is a valuable specimen, to show the nature of a crystal terminated on all sides, and independent, or not fixed on any gangue. This is not common to sulphate of barytes. It has only a few quartz crystals at the upper corner, as expressed in the figure. The modification is altogether singular, and is a variety not yet figured; we find it has 23 faces, some scarcely distinct. The crystal is lengthened parallel to the obtuse angles of the rhomb, and the upper primitive face, which shows the prismatic hues somewhat below the surface. It has little hollows as it were unsupplied by molecules; this is the case also in other parts,

giving the crystal a rough appearance. These hollows agree very well, when narrowly examined, with the shape of the nucleus. The general form will be better understood by examining *the geometrical figure* at the bottom, containing a figure of the primitive or rhomboidal prism: see *tab.* 70; allowing for the perspective, and conceiving the sharp angles as the obtuse ones, viz. *the right and left hand angles;* the upper and lower faces and the four corners are primitive faces corresponding with the six faces of the nucleus. The four larger octangular faces are evidently parallel to the acute corners of the rhomb (allowing for the perspective). In their formation, the laminæ are (as it were) arranged on the upper and under primitive faces, decreasing from the four acute angles of the nucleus from four obtuse angles; the same also forming 2 long quadrangular faces at the left hand end, and 2 large hexangular ones at the other end of the geometrical figure coming in contact with the primitive faces at the corners, at an angle of about 123° with the upper or under primitive faces. Next to these, on the same angle of the nucleus, are two other 4-sided faces above and below, the larger at an angle of 140° 59′ 2″ upon the primitive, and the smaller at one of 162° 2′ 44″. These may be distinctly seen on the top of *the upper figure*.

The Cumberland specimens seem to have the face of 123°, which appears not to have been seen by Haüy. Mr. Hailstone's specimen has two small faces marked by dotted lines on the right hand front corner, and one on the right hand corner at the back, which agree with the faces *y* of Haüy. This I have not seen in any other English specimen.

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TAB. XCIX.

FERRUM sulphureum.

Sulphuret of Iron; Iron Pyrites.

Class 3. Metals. *Order* 1. Homogeneous.
Gen. 6. Iron. *Spec.* 6. Sulphuret.
Div. 1. Crystallized. *Var.* Octaëdral, &c.

SYN. Fer sulfuré octaëdre. *Haüy, v.* 4. 69.

OCTAEDRAL Pyrites is not so common as cubical Pyrites; we have it however along with various substances, as calcareous spar, limestone, coal, &c. The present figures are designed to show this modification from the cube passing into what Haüy calls the cubo-octaëdre, thence into the perfect octaëdron. At the commencement of this change the corners of the cube are replaced by triangular faces—see *the left hand figure*—which, as the modification goes on, become planes of six sides each—see *the middle figure*—and at last the primitive faces are lost. These six-sided planes are reduced again to triangular ones, forming the octaëdron.

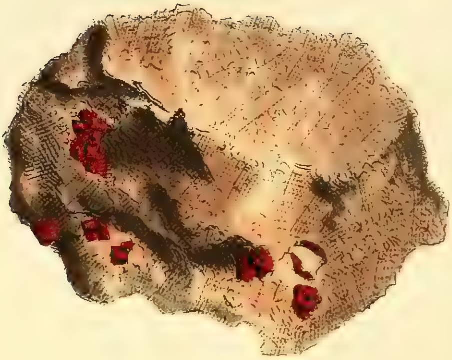
I am indebted to the late Lady Elizabeth Noel of Bath for *the upper* and *right hand specimens.* The first is the cast of a shell of the *Trochus* genus; and it should seem that the crystals are on the cast in place of the shell, as the rock is about the thickness of the shell from the cast, and is a mould of the outside of the shell. *On the left hand side* remains a bit of the rock, and on *the right hand* are exhibited the thickness and calcareous remains of the shells, sufficient to indicate the species to a conchologist, which appears to be

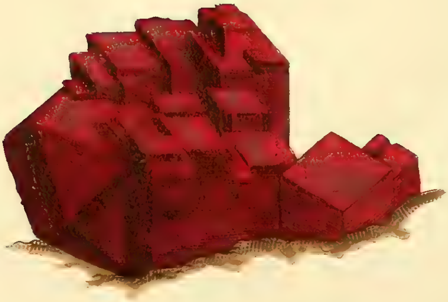
different from any shells of the present age. This is taken from another specimen which also came from Bath by favour of T. Walford, Esq. The pyrites on this are octaëdrons, some of which have their solid angles slightly truncated. It nearest resembles *Trochus niloticus Linn.*, but we do not consider it as that species.

The cast of the shell on *the right hand*, of a golden hue, being covered with pyrites, generally deeply truncated, seems a species of *Mytilus* cut off in the manner of *Donax denticulata Linn.* The shell on *the left hand* seems to be a *Tellina*, and includes pyrites, chiefly of a cubo-octaëdral form—see *left hand bottom figure*—as it were hermetically sealed in, and of course not discovered till the shell was broken. How these crystals came there may excite wonder; but, were we sufficiently acquainted with nature's operations, we should see every natural cause as well as its effect. This shell most nearly resembles Lister's *Tellina lata rugosa, tab.* 390. *f.* 229.

These fossils are in great abundance above the sand quarries at Woolwich and Charlton, about nine feet from the surface of the hill, in a loose marly stratum, from one to six feet thick.

How long they have been preserved there is not known; they however will soon rot and decay after exposure to the air. The other sorts of shells are two species of *Turbo*, probably of the same date; these will also fall to pieces. Of oyster shells there is great abundance, which do not, to my knowledge, differ from those at present known, nor do they decay so readily as the others. There are other shells in this curious place, and in Lady Wilson's park at Charlton, with specimens of which I have been favoured by her ladyship. I have gathered the more common ones myself.





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TAB. C.

CUPRUM oxygenizatum; *var.* cubicum.

Cubical Red Oxide of Copper.

SYN. Cuivre oxydé rouge cubique. *Haüy, v. 3. 557.*

GOOD cubical crystallizations of Red Oxide of Copper are much rarer than octaëdrons: see *tab.* 53.

This specimen came from near Redruth in Cornwall. It is crystallized in distinct cubes sometimes, but oftener in rather irregular groups, yet with their edges and planes parallel to each other, seldom like Fluor, *tab.* 73, or Galæna, *tab.* 24, &c., which are generally more confused. It rarely forms large cubes, although I understand that some have been found a quarter of an inch in diameter. They are often truncated at their solid angles, forming the cubo-octaëdre of Haüy, *t.* 63 and 71. *The magnified figure* represents a group somewhat like one on the specimen, which has a large cubo-octaëdre at *the left hand corner,* and the rest consists of various sized cubes, and one or two of another group, showing that the different groups may stand in different directions.

These are more generally of a more beautiful Bohemian or Scotch garnet* colour than the octaëdrons. We know of no difference in their substances.

* Now called *Pyrope*, differing from the common garnet in colour, transparency, and in never being crystallized. It should seem also that they may be still further subdivided.

SYSTEMATICAL INDEX

TO

VOL. I.

ALPHABETICAL INDEX

OF

PLATES, &c.

TO

VOL. I.

* The miners' name for Galæna.

* Rhomboidal coal (commonly called dice coal), in contradistinction to coals which do not break in rhombs.

* Werner's name for compact limestone.

† Werner's name for corundum.

‡ Werner's name for chalk.

§ Emmerling's name for amphigene.

* Werner's name for quartz.

* Townson's name for analcime.

† The common French name for analcime.

* Werner's name for strontia.

† Hope's name for strontia.

‡ Werner's name for sulphate of iron.

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CORRIGENDA.

Page 7 Line 5, *from the bottom, read* Chaux carbonatée.
9 —— 2, *for* inversus *read* inversa.
10 —— 1 and 2 *to be erased.*
11 —— 2, *after* Calx *insert* carbonata var.
13 —— 9, *for* stalactites *read* carbonata var. stalactitica.
— —— 3, *for* lime stalactites *read* stalactitical carbonate of lime.
15 —— 2, *for* creta *read* carbonata var. cretacea.
17 —— 2, *after* calx *insert* carbonata var.
21 —— 2, *after* calx *insert* carbonata var.
35 —— 2, *for* Silex arenacea var. calcarea *read* Quartzum arenaceum var. calcareum.
37 —— 2, *after* Argentum *insert* nativum var.
41 —— 2, *after* Cuprum *insert* nativum var.
— —— 7, *for* v. *read* p.
44 —— 17, *for* species *read* variety.
52 —— 11 *from bottom, after* soda *insert* muriata var.
53 —— 2, *for* sulphuratum *read* sulphatum.
55 —— 2, *for* Galæna *read* sulphureum.
— —— 3, *for* sulphure *read* sulphuret.
— —— 5, *for* sulphate *read* sulphuret.
59 —— 3, *asterisk on this line is to be placed next to,* white part *on line 5 from bottom.*
65 —— 2, *for* sulphuratum *read* sulphatum.
70 —— 2, *for* sulphuratum *read* sulphatum.
83 —— 2, *for* arenacea *read* Quartzum var. arenaceum.
87 —— 16, *for* 40′ *read* 4′.
107 —— 2, *for* Gagas *read* Carburetum.
112 —— *last, for* Groghan *read* Croaghan.
120 —— 3, *for* pleats *read* plaits.
121 —— 8, *for* glass-kopt *read* glass-kopf.
123 —— 3 *from bottom, for* humerus *read* femur.
145 —— 2 *from bottom, for* ey *read* eye.
153 —— 5, *for* oxygenized *read* sulphuret of.
171 —— *last, for* chalcedony *read* calcedony.
191 —— 2, *for* Silex Quartzum *read* Quartzum farcimen.
197 —— 2, *for* sulfata *read* sulphata.
209 —— 7, *from bottom, in the first column, for* 5 *read* 4.
— —— 12, *do. do. for* 4 *read* 3.
— —— 26, *from bottom, in the second column, for* 6 *read* 5.
— —— *in the first column, after last line, read* inversus, t. 4.
210 —— 25, *in the second column, for* 3 *read* 5.
— —— 29, *do. for* 5 *read* 3, *and transpose lines* 29, 30, 31, 32, *before* 25, 26, 27, 28.
— —— *in the second column, after line* 49 *read* carbonatum, t. 89,
—————— 90,
—————— 91.
215 —— 28, *for* Eisen-erse *read* Eisen-erde.

When sulphuratum *is used as a specific name, read, instead of it,* sulphureum.